AUIOMAIC ORGANIZATION OF E-MAIL APPLICATION USING INTELLIGENT AGENTS

A project submitted to Dean of Postgraduate Studies and Research in partial fulfillment of the requirements for the Degree Master of Science (Information Technology)

Universiti Utara Malaysia

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ABSTRACT

Email is one of the best things about the internet. Email is an effective tool, it allows any individual to communicate with his family and friends all over the world and learn about online support a group. E-mail has become the way for much of the world's correspondence. These benefits become problems when the volume of use becomes very large. Sometimes a person can review so many emails daily, so how can he organize incoming emails to highlights the email that is important Hence, this study proposes automatic organize e-mails application using of Intelligent Agents (IA) for categorization and managing received e-mails.

DEDICATION

First, I would like to dedicate this work to the good pacemaker; who taught us to keen to seek the knowledge, our Prophet Muhammad (peace upon him).

I dedicate this humble work to my beloved father and mother; the spring of loyalty, affection, and dedication. They raised me on the principles of virtue, to my dear sisters, to my grandmother soul and to who had always encouraged me to knowledge and studying my dear grandfather Prof. Dr. Affif Abdelrahmann.

I dedicate this work also to my cousin Ayman Abu Alhayjaa "Abu Saad".

I am also expressing my great thankful to all my colleagues and friends at UUM, for their support, with whom I shared pleasant times, and all my family members for their encouragement and support all the period of my studying, and to my ABU ALHAYJAA family.

Your Son:

Sami Abu alhayjaa

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Praise to **ALLAH** for his guidance and blessing for giving me the strength and perseverance to complete this project. Also, my thanks to **ALLAH** who has seen me through to this level in my academic achievement; I would like to thank my supervisor **Assoc. Prof. Dr. Wan Rozaini Sheik Osman** for kindly supervising this study, her guidance and constant motivation that has enabled me to complete my project work. Moreover, I would also like to thank my evaluator **Dr. Jamaiah Binti Haji Yahaya** for her suggestions and help.

SAMI ABUALHAYJAA

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CHAPTER ONE

INTRODUCTION

This chapter elaborates the main idea of this work, why the study was conducted and what is the main element involved in the study. The first sub-topic describes the overall idea in this study through the scenario and motivation that lead to the implementation of the whole project. This is followed by the problem statement, research question, objectives, significance and scope of the study. The last sub-topic elaborates the way this report is organized.

1.0 Introduction

E-mail is a timely and efficient communication tool used to complete official activities and to carry out with the citizens, with business partners and business within government. E-mail has become an important element of any office automation system. It speeds up the decision making process and reduces official procedure, expedites exchange of information, resulting in increased productivity, reduced costs and better delivery of services.

Email is an effective tool, it allows any individual to communicate with his family and friends all over the world and find out about online support a group. E-mail overload may be considered one case of "data overload," mail overload occurs when the e-mail user is unable to select the relevant messages for their context from the complete list of messages (Wei et. al, 2004).

E-mail filtering is processing e-mail for staging under specific scale. This refers to automatic processing of incoming messages frequently, but also term applies to enter human intelligence, in addition to techniques for combating spam, and outgoing e-mail messages as well as those received. Filtering e-mail programs inputs. For the production and it may pass the message unchanged through the delivery of user mailbox, redirecting a message for delivery elsewhere, or even throw away a letter (Microsoft, 2006). Agent technology characterizes the current state of software design in the area of distributed systems and applications. (Genesereth et al., 1994)

Intelligent agents have been successfully used for personal assistants, intelligent user interfaces, and managing electronic mail and they represent a new type of software with significant prospective for a wide scale of Internet applications (Pivk and Gams, 2000) . Our automatic organizing of e-mail application based on Intelligent Agents consists of three agents of Control Agent (CA), Organizer Agent (OA) and Filtering Agent (FA).

Usability is a multidimensional construct and can be assessed using various criteria. This project applies the definition of (ISO 9241-11, 1998) that examines effectiveness, efficiency, and satisfaction. (ISO 9241-11, 1998) defines usability and explains how to identify the information which is necessary to take into account when specifying or evaluating usability of a visual display terminal in terms of measures of user performance and satisfaction. Guidance is given on how to describe the context of use of the product (hardware, software or service) and the relevant measures of usability in an explicit way. The guidance is given in the form of general principles and techniques, rather than in the form of requirements to use specific methods.

1.1 Problem Statement

Email users are reporting email overload frequently, too many messages coming in, and inboxes overflowing. This problem focuses on some common problems faced by email users and what can be done to relieve the email headache. Nobody can control completely the volume of received emails. With the exception of subscriptions, most email is unrequested by the user. The Issue is not the volume, but the distractions left lingering in the inbox continually. How many emails received daily is irrelevant if the email one managed (LaFleur, 2005).

Sometimes a person can review so many emails daily, so it is how the incoming email be organize to highlights the email that is important. According to Centre for Technology in Government (1998), email overload is a major problem in the workplace. The amount of emails received every day is continuously increasing; strain and productivity to fall. Email overload affects immediately in persons' stress levels, and also the total time that they spend to manage their workplace email. (Pratt, 2006; Caspar et al., 2005)

The problem that appeared in this study can generate the following difficulties:

- Getting more email than they can handle.
- Spending too much time dealing with email.
- Being unable to respond to email in a timely manner.
- Cannot find information they need in email.
- Mailbox become full, they cannot import email.

Therefore, this study will focus on design an automatic organize and categorize e-mail application in order to incoming destination, moreover, the proposed application will design Dashboard to show incoming e-mails using intelligent agent (IA) for organize and categorize e-mails automatically.

1.2 Research Questions

This study aims to solve the following questions:

- What are the requirements to model an automatic organization of emails application?
- How to develop an application for organize e-mail automatically?
- How to organize e-mails automatically?

1.3 Research Objectives

The research question provides this study with the understanding to the user requirements that need to achieve the study goals such as:

- To model the requirements of web based Automatic organization emails Application.
- To formulate and design the intelligent agent automatic organize E-mails application architecture.
- To develop the intelligent agent automatic organize E-mails application system.
- To test the proposed application using usability testing model.

1.4 Research Scope

The scope of this study will design an automatic organize e-mails application to assist users for dealing with their e-mails. This study will be focused on providing users with the useful services for manage incoming e-mails.

1.5 Research Significance

The significance of this study is able to provide the flexibility to the users through use a web application to organize and review their emails. A review on the literature could provide a clear image about the importance of implementing automatic organize email application. Intelligent agent (IA) technique will be used in this study for categorize the e-mails and display it in a web dashboard .The proposed application will used to provide the user with the details about the destination of incoming emails. In addition, some advantage will be generated from implementing the proposed application, such as:

- Improve issuance speed and accuracy: - Designing the organize emails via IA application nearly eliminates the required support for organize the emails processing manually.
- Reduce the time and the effort: - Designing the organize emails via IA application can help on reducing the user time and effort for review the incoming emails.
- Give the opportunity to the user to easily and flexible review for important e-mails.

1.6 Organization of the Report

Chapter two discusses the related literature on the issue of the e-mail systems and other intelligent applications in different countries based on web technology.

Chapter three describes the research methodology which is developed by Vaishnavi and Kothari (2007) is adapted in this study. Moreover, the System Research Process Methodology (Nunamaker *et al.* 1990) will used to develop system prototype in this chapter. Overview of the methodology and the executive summary will briefly discuss.

Chapter four presents and discusses the built the architecture and design of the proposed system to solve the current problem and the finding of this study using Prometheus methodology.

Chapter five presents and discusses the implementation of the proposed system to solve the current problem and the finding of this study using FIPA compliant JADE agent framework.

Chapter six discusses the results process of the proposed system based on utilizing usability evaluation model and conclusion to the study.

1.7 Summary

The research elements of this study have been addressed successfully in this chapter based on the existing recharging problem. This chapter described the motivation factors that lead to the selection of the area studied. It also explains the existing problem that need to solve, research question, objectives of the study, as well as its significances to the real world situation. These elements are important as it ignites the implementation of the project. The next chapter deals with the literature review which elaborates on related works that have been established in the different fields.

CHAPTER TWO

LITERATURE REVIEW

This chapter presents the literature review on the area of project studied. It conceptually gives an insight or reviews on the previous and existing works that have been conducted on the same area. According to the title of the project, this chapter is organized in three sections of subtopics. The first sections reviews on the introduction of the E-mail Systems and its applications. Meanwhile, the second subtopic reviews on intelligent agent systems. Our automatic organizing of e-mail application based on Intelligent Agents consists of three agents of Control Agent (CA), Organizer Agent (OA) and Filtering Agent (FA). Other than that, the last subtopic reviews on related works.

The literature review is also presents usability testing. Usability testing is a method of evaluating the usability of a given product in a given environment. In addition, there are many ways to formally evaluate the usability of a Web application. This part combines between usability testing and SM because SM is the kind of web application.

2.1 E-mail Overload

There are lots of works done in the area of email classification, grouping emails into folders but less work on grouping emails into users' activities.

Activities in email message are what the email is all about. Whittaker (1996) has written about the email organization issue. He presented the email overload concept and discussed

among other issues; why users file their e-mails in folder structures. He identifies a number of reasons: users want to clean their inbox but still keep the emails; users believe that they will need the emails in the future and users want to postpone the decision about an action to be taken in order to determine the value of the information contained in the emails.

2.2 E- Mail Organizing

The problem of email overload (Whittaker and Sidner, 1996) is now widely acknowledged and has found a lot of attention even in the popular media. A variety of solutions have been proposed, including task-based (Whittaker et al., 2006), activity-based (Dredze et al., 2006), priority-based, (Horvitz et al., 1999), and sender-based (Balter and Sidner, 2002) organization schemes. For example, Dredze et al. (2006) provide successful algorithms to recognize emails that belong to particular activities, such as organizing a conference, reviewing papers, or purchasing equipment. Our approach is more general as it covers all kinds of discussions, but comes at the price of slightly decreased accuracy.

2.3 Clustering E-mails

Clustering is using as a means to derive the topics, not as an end in its own body. Clustering emails has been tried to get characteristic concepts (Boone, 1998). There were the clusters form in advance and the concept words are the ones that were most popular among the documents in the group. In Huang (2004) clustering was used to get information about each group of documents who sent the most emails, obtain names and dates, and task classification.

2.4 Intelligent Agents

Roesler and Hawkins (1994), define the intelligent agents as an independent computer programs operating with software environments such operating systems, computer networks or databases.

In general, intelligent agents defined as software entities that help their users and carry out their support. Agents make our life easier, save time, and simplify the growing complexity of the world, it like assistant or personal advisor, who learns what you like and can expect what you want and need. The concept of intelligence is almost the same of human intelligence. The agent is able to learn from itself, from the external environment and from other agents through a relation of collaboration interaction with its user. Thus, an agent operates as an individual from the user, can change itself to the several of experiences and change its behaviour according to them. (Russell and Norvig, 1995; Cohen, 1994) (Bratko, 1986; Etzioni et al., 1993).

Living in the computer age, we find that the "information highway" is truly a high-speed information center making some "travelers" dizzy. Intelligent software agents can help alleviate the problems with the amount of information received. What exactly is an intelligent software agent? They are autonomous computer programs, where their environment dynamically affects their behavior and strategy for problem solving.

There are three distinct classes of agents, which can be easily identified. The first level of intelligent agents is the gopher agent, which function by executing straightforward tasks based on predetermined rules and assumptions. The second level of sophistication is where the service-performing agents execute a well-defined task at the request of the user. Finally,

predictive agents volunteer information or services to a user without being explicitly directed, whenever it is deemed appropriate.

Characteristics of Intelligent Agents

A typical intelligent software agent (ISA) is should contain the following main characteristics:

Autonomy: Agents should be able to do most of their tasks without any direct assistance from an outside source, which includes human and other agents, while controlling their own actions and states.

Social Ability: Agents should be able to interact with, when they deem appropriate, other software agents and humans.

Responsiveness: Agents should respond in a timely fashion to perceived changes in the environment, including changes in the physical world, other agents, or the Internet.

Proactiveness: Agents should be able to exhibit goal-directed behavior.

"At a higher level, agents are also expected to perform other functions such as mobility, rationality, adaptivity, benevolence, and collaboration. All these characteristics enable an ISA to better represent its creator in the typically volatile WWW environment in which it operates." (Khoo et al, 1998)

As can be seen, "this technology combines artificial intelligence (reasoning, planning, natural language processing, etc.) with system development techniques (object-oriented programming, scripting languages, human-machine interface, distributed processing, etc.) to produce a new generation of software that can, based on the user's preference, perform tasks for that user." (Roesler & Hawkins, 1994)

Applications

There are many applications that make use of intelligent agents. This range includes personalized information management (such as organizing and filtering email), electronic commerce (such as locating information for purchasing and buying), and management of complex commercial and industrial processes (such as scheduling appointments and air traffic control).

In the age of computers, information is readily available on the Internet, whether they are useful or useless. There is so much data available that we often claim to be "overloaded with information". Having too much data can cause as much trouble as having no data, as we must shift through so much information to get what we need. We can categorize this information overload problem into two divisions:

Information filtering: We must go through an enormous amount of information to find the small portion that is relevant to us.

Information gathering: There is not enough information available to us and we have to search long and hard to find what we need.

In our project, we shall focus more on the information-filtering problem. As was described previously, users can be easily overloaded with information. Users need a way of filtering this data into a more manageable situation.

"Knowledge workers" (such as managers, technical professionals, and marketing personnel) need information in a timely manner as it can greatly affect their success.

Tasks performed by administrative and clerical personnel can be automated thereby greatly reducing the labor costs and increase office productivity. Today, labor costs are estimated to be as much as 60 percent of the total information delivery costs of sales, service, and support organizations.

Tasks that are redundant or routine need to be minimized by some individuals that can otherwise spend their time more productively. (Roesler & Hawkins, 1994)

Some companies receive so much email that they have to employ clerical worker to sift through the flood of e-mail, answering basic queries and forward others to specialized workers. A recent survey conducted by the Institute for the Future in Menlo Park, Calif., showed that 71% of 972 Fortune 1,000 workers interviewed felt overwhelmed by the number of messages they send and receive each day. Some companies have spent $50,000 to set up an intelligent agent server to filter email. Although these systems cost a lot, users are confident that they will recoup costs by lowering head count. A software company that uses the Aptex product estimates its return on investment to be one year or so because it will avoid hiring several highly paid support personnel. Amoco is using GrapeVine for Lotus Notes from GrapeVine Technologies Ltd. In Troy, Mich., which filters and routes much of the data coming in off the wires. "It helps us get through the information pollution," Joe Jesson, a staff consultant at Amoco said. The software reads a pre-established "knowledge chart" to determine who should receive what mail. "We think we can cut those 200 messages down to a more manageable dozen," he said. (Cole-Gomolski, 1997)

"'Intelligent agent services can supplement but not replace the value of edited information, 'according to Jason Seiken (director of online services for Digital Inc.): 'Our philosophy is to give people both options.'

'There's a sea of information, but it's a sea of information that you feel like you're drowning in.' As information becomes more available, 'It becomes more and more crucial to have strong editors filter that information', Seiken said." (Webb, 1995)

Even the CEO of Verity, Philippe Courtot agrees. "There is so much content out there," said Courtot, "that the tools that filter content are going to be as important as the content itself." (Wingfield, 1995)

2.5 Related Works

According to Faulring et al. (2010), Reflective Agents with Distributed Adaptive Reasoning (RADAR) is a multi agent system with a mixed initiative user interface designed to help office workers deal with email overload. RADAR agents observe experts to learn models of their strategies and use the models to assist other people who are working on similar tasks. The agents' assistance helps a person to transition from the normal email-centric workflow to a more efficient task-centric workflow. The Email Classifier learns to identify tasks contained with-in emails and then inspects new emails for similar tasks. A new task management user interface displays the found tasks in a to-do list, which has integrated support for performing the tasks. The Multitask Coordination Assistant learns a model of the order in which experts perform tasks and suggests a schedule to other people who are working on similar tasks. A new Progress Bar displays the suggested schedule of incomplete tasks as well as the completed tasks. A large evaluation demonstrated that novice users confronted with an email overload test performed significantly better when assisted by the RADAR agents.

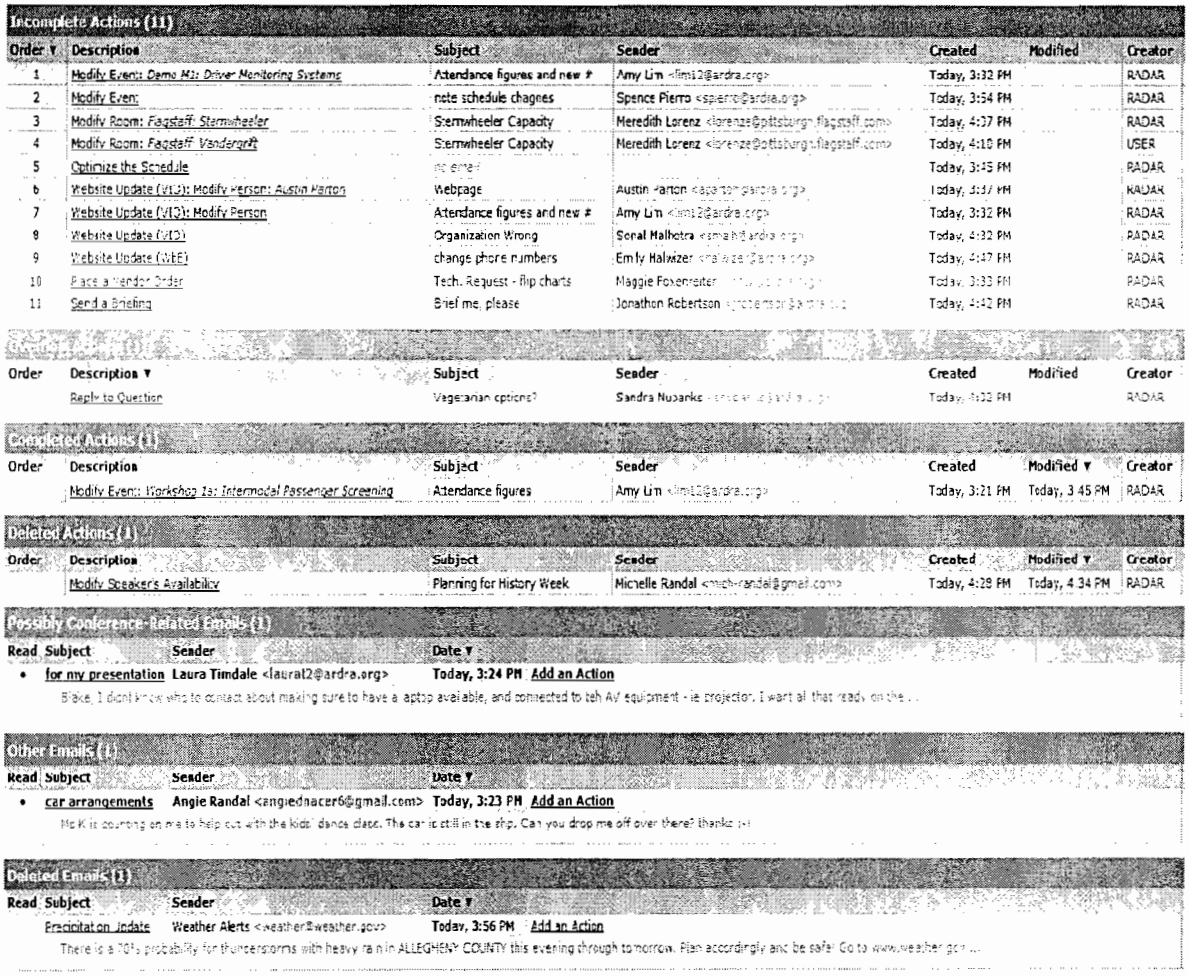

Figure 2.1: The RADAR Action List provides a task-centric view of an email inbox (Faulring et al., 2010).

The main problem will be making the Artificial Intelligent (AI) components robust enough for use with emails and integrating the AI technologies and the user interface with the real forms that are used to perform the tasks.

In Cselle et al. (2007), they present an email client extension that helps users deal with email overload called "BuzzTrack". This program enhances the interface to present messages grouped by topic, instead of the traditional approach of organizing email in folders. We discuss a clustering algorithm that creates the topic-based grouping, and a discovering for

labelling the resulting clusters to summarize their contents. BuzzTrack's organization structure which can be obtained at no cost to the end user will be helpful for managing the large amounts of incoming email that land in the inbox every day.

In Ho et al. (2003) study, they illustrated an E-Mail Management Assistant system (EMMA), an e-mail system do a primarily sorting messages into virtual folders, and prioritizing, reading, automatically replying, archiving and deleting mail items. EMMA reaches a high degree of accuracy on email classification by using a RDR rule-based approach (Ripple Down Rules) as the root of rule construction. Since, RDR systems making EMMA easy to use and it's provide wide-ranging assist to the user in defining rules and maintaining the consistency of a rule base. Figure 1 shows the rule is constructing in the upper portion of the window.

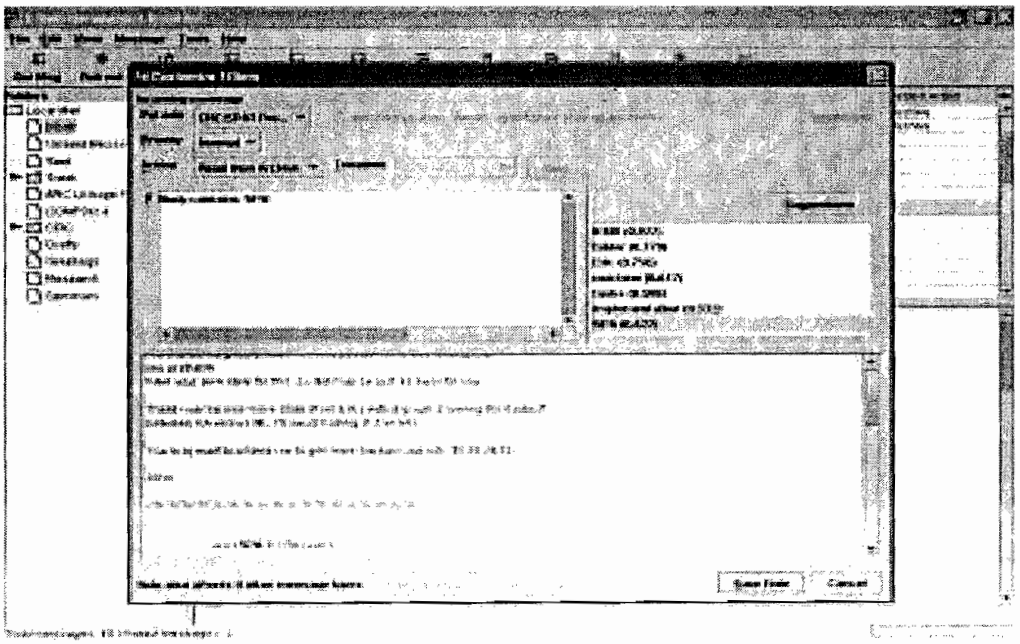

Figure 2.2: EMMA Rule Building Interface (Ho et al. 2003)

They used a Bayesian classification algorithm to suggest keywords for filing messages into a given folder, suggest a folder for filing a given e-mail, and building interest profiles characterizing a user's folders.

Surendran et al. (2005) took about a procedure to automatically discover user personal topics via clustering their emails. They automatically label topics using suitable keywords and applied strong filters that use domain knowledge about e-mail and the workplace of the user. In addition, they generate an email/ document browser that makes use of the suitable keywords as standing queries to create virtual folders that aid organize, index and retrieve email efficiently. This study offered a method to automatically extract a person's topics of interest through clustering email.

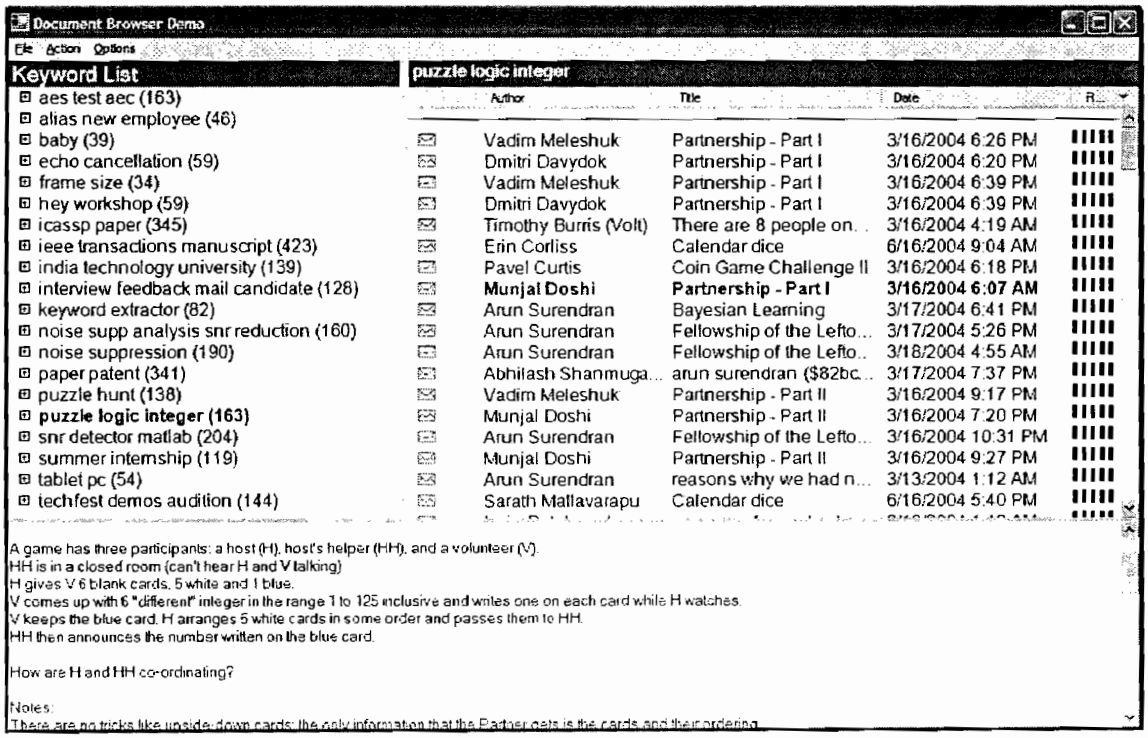

Figure 2.3: The Personalized Email/Document Browser based on automatically discovered personal topics (Surendran et al., 2005)

In Lazzari et al. (2005) study, designed a multi-agent system which goaled to figure out spam filtering in users' mail. The Collaborative Agents for Filtering E-mails (CAFÉ) connects every user with a proxy agent that acts as an interface between the user's e-mail client and the server. The proxy agent sorts messages into three groups: ham (good messages), spam and spam-presumed support of other agents.

"The system analyzes each message using three approaches: the first is based on a hash function, the second (static) on DNSBL (DNS-based Black Lists) databases and the third (dynamic) on a Bayesian filter." they give a mathematical representation of the system, showing that if the users collaborate, the fault probability decreases in proportion to the number of active users.

This study combine two components for solve the spam filtering problem: a multi-agent architecture for messages analysis and a collaborative approach based on users' spam notification.

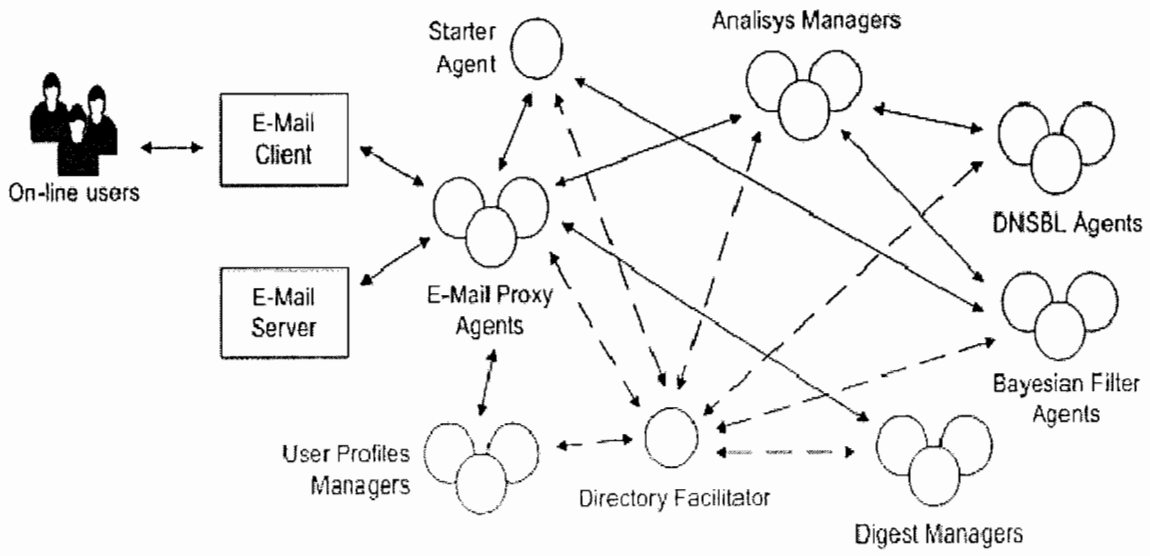

Figure 2.4: CAFE platform architecture (Lazzari et al., 2005)

Abu-Hakim et al. (2001) study illustrates the implementation and design of an agent based system that provides automatic interpretation and content highlighting of electronic text. The architecture has been deployed in a commercial product that provides email content interpretation that allows a user to acquire a fast overview of their email message content.

They used AmikaFreedom algorithm that intelligently summarizes email. Moreover, they adopted an agent-based approach to implementing the system for that the system must be as easy to use as possible, be capable of integration into the user's email environment and provide a loosely coupled, flexible architecture for extension and maintenance. In addition, it was important to plan for dynamic resource management and security, particularly as the product is designed to be closely integrated with mail tools.

The following figure shows the architecture of the AmikaFreedom which consists of four collaborating agents that together provide a robust architecture for generating email highlights

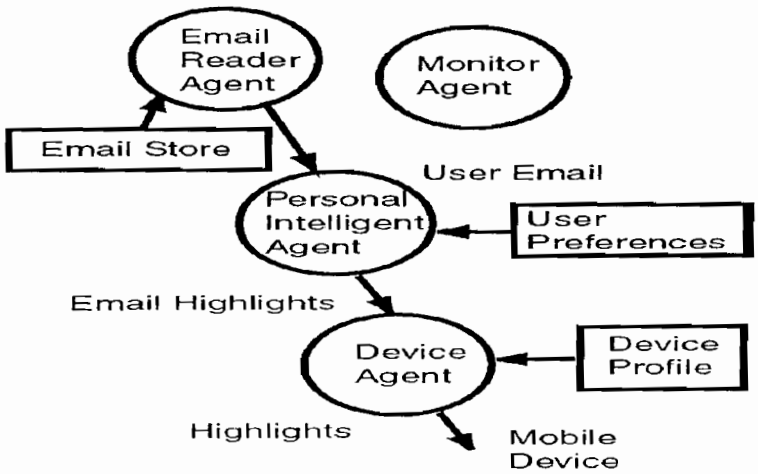

Figure 2.5: AmikaFreedom agent architecture (Abu-Hakim et al., 2001)

In Ayodele et al. (2009) study, they present a new framework to improve and assist organised and prioritized emails. They proposed an intelligent email prediction system (IEPS) which aimed to enhance organise emails in mail boxes, prioritise emails based on the focus of the email content. This system helps to improve the performance of email users, saves time, very effective and efficient tool and is cost effective for businesses and for personal use. In addition, IEPS system learns from human participant categorised data tests.

2.6 Usability Testing

A large number of studies over the years have evaluated the usability of web sites. Each study proposed their models and methods for web site usability evaluation. A lot of factors in their models are overlapping yet are still important factors that contribute in usability evaluation. In this review of related paper, we maintain our focus on research concerning web site usability evaluation and do not cover other types of usability evaluation

Nielsen (1993) described usability according to five basic parameters; 1) easiness and speed of learning of system use 2) efficiency to use 3) easiness to remember system use after certain period of time 4) reduced numbers of user errors and easy recovery from them and 5) subjective satisfaction of users. Many authors further the study of research in usability based on these 5 characteristics. Virzi (1992) suggests that five users uncover approximately 80% of usability problems and agreed by Nielsen (1993). Faulkner (2003) further suggested that 15 users can uncover 90-97% of usability problems. (Carstens and Patterson, 2005) mentioned that there should be specific usability guidelines for specific type of website.

According to ISO 13407-11, Web usability is the effectiveness, efficiency and satisfaction with which the users use a website to achieve their goals although there are many different versions of definition for the term, web usability. (Duan and Zhang, 2007) proposed a visualization technique to visualize invisible information to make ease of usability analysis. Based on their study on information visualization, it can optimize the use of our perceptual and visual thinking ability to deal with phenomena that is not in visual-spatial representations. This technique is implemented on Sit Usability Analysis Tool (SUAT). However SUAT can only assist usability expert to find usability problem but cannot give usability about a website directly.

Web accessibility is about people being able to get and use the web content. It is about designing web pages that people can present and interact with according to their needs and preference. Nijad (2007) studied the correlation between web usability and web accessibility. Based on his study, web accessibility is a subset of web usability while usability is also an important aspect of accessibility. He also found that specific user analysis is conducted for web users and the range of users considered is often too narrow. He aims at Universal Design which is all possible users and environments are considered in website design includes benefits to people with disabilities.

According to Nielsen (1993), the highly quoted user-centered design methodology is considered applicable in web application. The three principles of user-centered design presented by Rubin (1994) are 1) An early focus on users and tasks 2) Empirical measurement of system usage and 3) Iterative design whereby a system is designed, modified and tested repeatedly. These three principles present usability evaluation indirectly. (Kostaras

and Xenos, 2004) suggested the heuristic evaluation method which is to be carried out by usability experts as it is easy to use, fast, relatively cheap and it can be employed in systems that are completed and fully operational. Heuristic evaluation is mainly based on rules of thumb by evaluators. Usability specialists will judge the compliance between user interface and usability principles called Heuristics either based on their own point of view or observation.

Sigala et al. (2000) argued that because the large volume of information that multimedia carries are disseminated over long distances immediately, the multimedia has "substantially improved the effectiveness and efficiency of information presentation and dissemination through electronic channels." Multimedia is important feature in website. Due to the internationalization and globalization attributes many industries; website usability is already closely connected with cross-cultural context. Cross-cultural means accommodate different cultures and having sufficient understanding to provide services for users in different time zones with different languages, cultures, currencies, and customs. Zhou and DeSantis, (2005) suggested that multimedia and cross-cultural context is the two main significant factors that will affect the usability of websites.

Piyasuruvej (2005) studied the usability of flash that applied to web. He found that flash obtained better feedback on usability than HTML which has been the only standard format for web publishing during 1990-1995. McGregor (2003) proposed guidelines regarding when to use flash or HTML. The combination of HTML and flash in web publishing definitely will give better usability than flash or HTML alone. Piyasuruvej (2005) also found that combination practice is not encouraging due to longer time needed for development and

higher cost for maintenance by interweaving those two approaches. He suggested user's characteristics, age, gender, culture; experience and web purpose can affect the evaluation of website usability while Riedman (2000) focused on region, ethnic and cultural background.

Chi et al. (2000) proposed a system for exploratory data analysis and predictive modelling of Web site use. It integrates research on human information foraging theory along with information visualization and data mining techniques. While many sites collect descriptive statistics on visitors, this model allows for the simulation of hypothetical users, and for the prediction of usability of alternate Web site designs. The authors are developing metrics that measure the quality of a Web site's 'information scent', or how easily users find the information that they seek, and at what cost.

Borges et al. (1996) formed general Web page design guidelines through a study of university and college Web sites. To evaluate these guidelines, they tested the original home page of three sites against a version of the home page revised according to their proposed guidelines. Usability was measured by task times on the original and revised home pages.

Kantner and Rosenbaum (1997) gave brief descriptions of several usability studies that they have conducted. They used a combination of heuristic evaluation and laboratory usability testing. When possible, they recommend an iterative sequence of heuristic evaluation to find obvious problems, followed by user testing to uncover deeper ones. Their testing seemed to focus on collecting data on task time, user errors, subjective satisfaction, preferences, and the path taken through the Web site.

Keevil (1998) presented a checklist that can be used to calculate a "usability index" for a Web site. The checklist is a series of yes/no questions under the general usability categories of finding information, understanding information, supporting user tasks, evaluating technical accuracy, and presenting information. The index is calculated as the percentage of 'yes' answers. Limitations of the described method include possible inconsistency in the sets of questions used for different Web sites, and the bias that evaluators may introduce in their interpretation of the questions.

Corry et al. (1997) conducted a usability evaluation of an existing university Web site. After needs analysis was used to restructure the information contained in the current Web site, a prototype was developed and tested against the existing site. Usability was based on the ability of subjects (such as students, parents, and faculty) to quickly and accurately locates answers to a set of questions. While the study worked well, the 4 Metrics used to measure usability were limited to task completion time and the number of user errors.

Table 2.1: Various Usability Measures

No	Usability	1	2	3	4	5	6	7	8	9
1	Consistency									
2	Provide feedback									
3	Provide helpful error messages									
4	Use simple and natural language									
5	Error prevention									
6	Redundant links									
7	Flexibility and efficiency of use									
8	Help and documentation									
9	Useful content									
10	Information Updates									
11	Multilingual services									
12	User control and freedom									

13	Minimize the user's memory load				■					■
14	Cross-cultural design		■							
15	Friendly image exhibition/gallery		■				■	■		
16	Good search engine		■				■			
17	Support different platform			■						
18	Aesthetic and minimalist design	■	■		■			■		
19	Clear contact information						■			
20	Appropriate for audience		■	■			■			
21	Visibility of system status				■			■		
22	Useful heading							■	■	
23	Flash					■				
24	Visa/policy & currency convert info		■							
25	Local info (weather and time)		■							

2.7. Summary

This chapter has discussed concept and definition of the intelligent agents and other issues regarding the email applications. An overview on email organizing has been discussed also. Finally, this chapter has outlined the perception and previous related work, which eventually helped in determining the previous agent techniques in different email services, based certain approaches. The literature review for usability model with web application, web accessibility, users and tasks, evaluation method, data analysis, usability testing, usability index, and usability evaluation for an existing university web has been described. And it is combined in table 2.1 above. The next chapters will discuss on research methodology

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter discusses the methodology that has been applied in this study. Methodology makes the applied approach easier for the project to be archived with the structure of the related process in the light of the phase defined. This study employed the research methodology that is adopted from general methodology in information systems research design (Vaishnavi & Kothari, 2007), with a slight addition phase that just comprised the development methodology phase. The phases of methodology section and summary section will discuss respectively.

3.1. Introduction

Research methodology is not an abstract of methods collection to carry out research; it is an organized way to solve the problem of finding (Kothari, 1985). The research methods refer to the techniques and methods used by the researcher in fulfill the research, for instance data processing techniques, data collection technique and instruments.

This study used a research methodology that has an agreeable method, excellently chosen, accepted and described among many researchers in Information System Research Design (Vaishnavi & Kothari, 2007). The research is conducted in several steps. The following Figure 3.1 illustrates the major steps of the design research methodology.

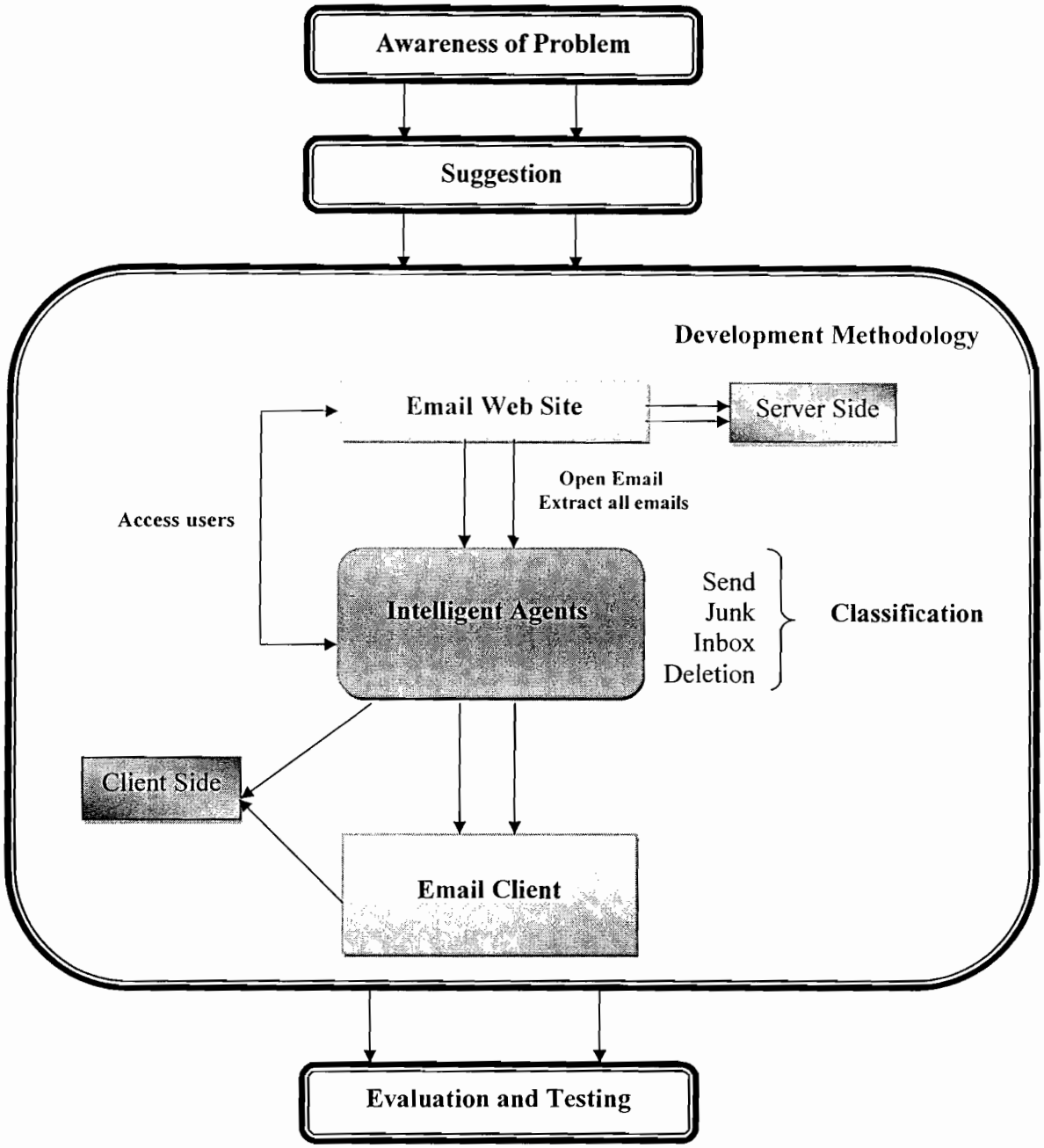

Figure 3.1: Research Methodology Steps

3.2. Awareness of Problem

Awareness of Problem is a phase of discovering potential research topics in a chosen field, and the understanding of the problem which needs to be solved. In addition, the field

selection was decided during this phase. Through discussion and related reviews of similar systems, a general idea of what should be included in the system was decided.

This phase will focus on gathering information related to research field to understand the problem of the email overloading and also the need to organize e-mails automatically. After the problem statement descriptive, the objective and the scope had been defined obviously; the proposal is the output of this phase, and that accomplished through discussion, the literature review and the pre survey questionnaire with students and asks them about their incentive to use this service.

In fact, we have to understand the research domain to come out with the objective of this study, the domain of the research is Email System; literature review had been carried out for the first three weeks of the research schedule. During the literature review period, ideas, information, issues and problems related to the Email system and the intelligent agent systems area were gathered. The information gathered and collected was reviewed from books, proceedings, journals, white paper, reports and news.

3.3. Suggestion

One of the major impacts on the quality of the systems developed is the software development approach adopted in order to develop a well-design application. A methodology consists of an approach to software development (object orientation), a set of techniques and notation that support the approach to structure the development process and unifying set of procedures.

The researcher used the object oriented approach in this system development. As information systems requirements are becoming increasingly complex, the use of object orientation approach is more necessary. Object oriented offers conceptual structures that support the sub-division in the system. It also aims to provide a mechanism to support the reuse of program code, design and analysis design.

The output of the second phase is the tentative design. The design of the system includes Prometheus Design Tool (PDT) diagrams, and a sketch of the system's architecture.

In this phase, the survey was to present the user requirements, it was with students from different UUM colleges and asked them about their requirements that need to achieve in the proposed application.

The students answered the previous questions and the answered was performed the requirements for the students or users to build the proposed application, however, the students accept willingly to organize large number of the incoming emails automatically using the intelligent agent because of many reasons such as, easy to use the application, reduce the user time and effort, can provide the users easily and flexible review for important e-mails

3.4. Development Methodology

3.4.1. System Development Steps

The application is constructed to accomplish the requirements that described in the design phase. This research was preceded with the design of the application based on the

information gathered and requirement in the previous step. In this phase, the designs that are formed in design phase and the analysis phase are changed to the efficient and suitable source code.

The system development steps of this study were adopted based on the System Research Process Methodology (Nunamaker *et al.* 1990). There are five phases involved to measure the process development shown in the following figure.

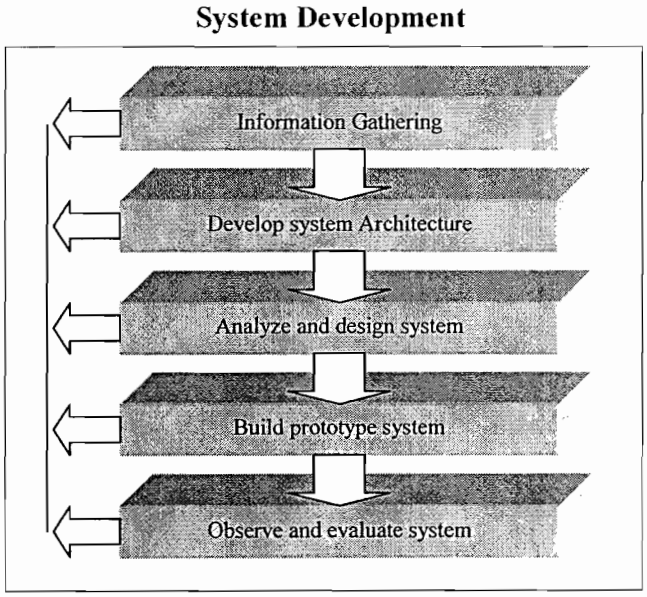

Figure 3.2: System Development Research Process Model

- **Information Gathering**

This phase of the methodology involves information gathering and all what is related to automatic organize of email application.

- **Develop System Architecture**

Based on the research and the solution provide the road map for the system building process. Define the constraints, functional and objective to develop the project.

- **Analyze and Design System**

Analyze system requirement and the research problem. Choose the suitable techniques to solve the problem.

- **Build Prototype System**

The application was built using web based programming. All concepts of frameworks and the suitable design were chosen and modified into a working application.

- **Observe and Evaluate the System**

Make experimental of the result to evaluate the application. Measure the requirement can be achieved. Checking code error and debugging.

In the same way, the application development steps that have been briefly discussed previously will all be explained later, in the fourth chapter.

3.5 Utilized Usability Model

Usability is a multidimensional construct and can be assessed using various criteria. This project applies the definition of (ISO 9241-11, 1998) that examines effectiveness, efficiency, and satisfaction. (ISO 9241-11, 1998) defines usability and explains how to identify the information which is necessary to take into account when specifying or evaluating usability of a visual display terminal in terms of measures of user performance and satisfaction. Guidance is given on how to describe the context of use of the product (hardware, software or service) and the relevant measures of usability in an explicit way. The guidance is given in

the form of general principles and techniques, rather than in the form of requirements to use specific methods.

The guidance in ISO 9241-11 (1998) can be used in procurement, design, development, evaluation, and communication of information about usability. ISO 9241-11 (1998) includes guidance on how the usability of a product can be specified and evaluated. It applies both to products intended for general application and products being acquired for or being developed within a specific organization.

ISO 9241-11 (1998) also explains how measures of user performance and satisfaction can be used to measure how any component of a work system affects the whole work system in use. The guidance includes procedures for measuring usability but does not detail all the activities to be undertaken. Specification of detailed user-based methods of measurement is beyond the scope of ISO 9241-11 (1998).

ISO 9241-11(1998) is considered as one of the most widely adopted and cited definitions of usability is that of the International Organization for Standardization, which identifies usability with the ability to use a product for its intended purposes: 'the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use ISO 9241-11 (1998).

According to the benefits and importance of ISO 9241-11 (1998), this project proposes an evaluation model for assessing usability of SMP. As reflected in the definition, three central criteria for usability are the effectiveness, efficiency and satisfaction with which users can achieve specified goals.

3.5.1 Effectiveness

The first criterion, effectiveness, suggests that specified goals are to be achieved with completeness (ISO 9241-11, 1998). Effectiveness can be understood as "how good a system is at doing what it is supposed to do" (Preece, Rogers and Sharp, 2002) and is related to the "utility" of the system (Grudin, 1992), and "to the extent to which the system provides the right kind of functionality so that users can do what they need or want to do" (Preece, Rogres, and Sharp, 2002). Effectiveness can also be defined as the accuracy and completeness with which users achieve certain goals.

Indicators of effectiveness include quality of solution and error rates. Moreover, quality of solution is used as the primary indicator of effectiveness, i.e. a measure of the outcome of the user's interaction with the system. In this project, effectiveness is to evaluate if the system as a whole can provide information and functionality effectively and is measured by how many answers are correct.

3.5.2 Efficiency

The second criterion, efficiency, suggests that specified goals are to be achieved with as little expenditure of resources as possible (ISO 9241-11, 1998). But in another way, measures of efficiency relate the level of effectiveness achieved to the expenditure of resources (Bevan, 1995). According to Bevan (1995), resources may be 'mental or physical effort, which can be used to give measures of human efficiency, or time, which can be used to give a measure of temporal efficiency, or financial cost, which can be used to give a measure of economic efficiency'.

Moreover efficiency, which is the relation between (1) the accuracy and completeness with which users achieve certain goals and (2) the resources expended in achieving them. Indicators of efficiency include task completion time and learning time. In this study, we use task completion time as the primary indicator of efficiency.

In addition, efficiency is likewise to evaluate if the system as a whole can be used to retrieve information efficiently and is measured.

3.5.3 Satisfaction

The third criterion, satisfaction, suggests that users should feel comfortable with, and have positive attitudes towards the use of the system (ISO 9241-11, 1998). In this sense, satisfaction relates to concepts such as ease of use, user satisfaction and usefulness (Davis, 1989) and (Mathieson and Keil, 1998). The 'specified context of use' includes users, tasks, equipment and the physical environment, where 'task' is defined in terms of activities required to achieve a goal (ISO 9241-11, 1998).

Satisfaction is the users' comfort with and positive attitudes towards the use of the system. Users' satisfaction can be measured by attitude rating scales. And can measure by use preference as the primary indicator of satisfaction.

Finally, Satisfaction looks into the areas of ease of use, organization of information, and visual attractiveness, and error handling and is measured by questionnaires. Ease of use is to evaluate user's perception on the ease of use of the system. Organization of information is to evaluate if the system's structure, layout, and organization meets the user's satisfaction.

Labeling is to evaluate from user's perception if the system provides clear labeling and if terminology used are easy to understand. Visual attractiveness evaluates the site's design to see if it is visually attractive. Contents evaluate the authority and accuracy of information provided. Error is to test if users may recover from mistakes easily and if they make mistakes easily due to system's design.

User's Criteria of "Quantitative Analysis of automatic organizing of e-mail application"

- Evaluate knowledge's culture
- Evaluate automatic organizing of e-mail application organization
- Concept of automatic organizing of e-mail application

User's Criteria of "Qualitative Analysis of automatic organizing of e-mail application"

- Culture of automatic organizing of e-mail application knowledge
- automatic organizing of e-mail application organization

From previous studies, we found interlocking relationships among effectiveness, efficiency, and satisfaction. The longer it took to perform a task, the greater the number of steps involved. The greater the number of steps involved in completing a task, the lower the satisfaction. The more time spent on completing a task, the lower the satisfaction. Further, incorrect answers entailed more steps, while correct answers entailed fewer steps. This means that when we knew how to locate the answer, it take fewer steps. Although there are interlocking relationships, effectiveness, efficiency, and satisfaction are three distinct criteria and should be measured separately. One cannot replace the other.

For that a usability assessment model has been developed in order to identify a comprehensive set of usability components needed to evaluate various aspects of is how the automatic organizing of e-mail application could be tested shown in Figure 3.3.

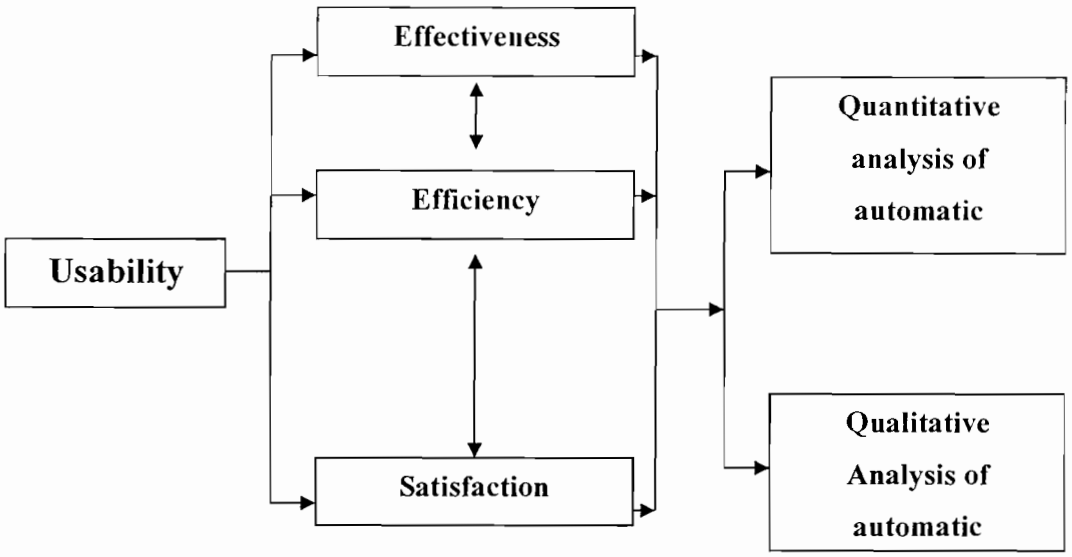

Figure 3.3: Usability Model

3.6 System Evaluation

3.6.1 Participants

The participants including System Analyst, System Developer, Software Engineer, and User and will be chosen to fill the questionnaire of this study. The participants should be applying the system before solving the questionnaire to be situated.

3.6.2 Procedure

In the beginning, the participants will receive a short, scripted verbal orientation explaining the purpose of the usability testing. Then they will be asked to complete a short background

questionnaire to collect their demographic characteristics. The participants will be asked to perform a set of information about how to test our system using the usability test. The tasks were written on a sheet of paper that included a space where participants will be asked to indicate their answers. Once the tasks are completed, participants will be asked to complete a short participant satisfaction questionnaire to collect and test their own perceptions towards our system.

3.6.3 Tasks

Participants will complete three tasks:

1. They will complete a background/experience questionnaire that *including name, gender, age, education level, Major/Department, and years of experience.*
2. They will perform tasks using the questionnaire's sheet.
3. There is also a post-survey questionnaire that specifically examines our system techniques. After completing a task, the participants will ask to rank satisfaction and to write down comments.

3.6.4 Data Collection

This evaluation model considers both quantifying elements of performance (experience and experiment) as well as subjective empirical. If the answer is wrong, or he/she not familiar with this question then skip to the second question until all the question will be solved. We will, however, record whether participants are able to complete tasks successfully. The criteria for successful task completion are:

- Participant is able to give a correct answer based on his own information about the system. Any guessed or assumed answers, whether correct or not, are not record as successfully completed tasks.

- Participant is able to give a definite answer to the question. Where participants indicated they are unsure about the answer or would seek clarification, the task will record as not successfully completed.

3.7 Questionnaires

The purpose of the questionnaire is to prove:

- Handle the interpretation of the term intelligent agents and the company's key objective in e-mail techniques.
- Handle the aspects that come into play in intelligent agents' techniques, such as the existence of a strategy, the processes of quality control of data, the content that is being managed, and the functioning of agents communities of practice.
- Identify the intelligent agents' techniques of willingness of cooperation for research work.

Basically, there are two types of questionnaire that we prepared as part of usability testing for the participants for the level of the questions.

3.7.1 Pre-Survey Questionnaire (background)

A series of questions designed to collect demographic information about the participants to assess their level of his information about the system as shown in Appendix A.

3.7.2 Post-Survey Questionnaire

After the test subject completed each scenario, he/she should answer a specific questions related to the tasks. To indicate whether the tasks was clear and completed successfully.

3.8 Summary

In sum, this chapter has discussed the methodology that been used in this project, where the methodology was assembled according to four phases was based on the project objectives as follows:

1. Awareness of the problem Phase
2. Suggestion Phase
3. Development Phase
4. Evaluation Phase
5. Data Collection Phase

This research employed the research methodology by Vaishnavi and Kothari (2007) as a guideline for the whole research process and this methodology has carefully choose System Research Process Methodology by Nunamaker *et al.* (1990), in order to develop the prototype for this study. This study focuses on the four phases lead to produce the proposed Automatic organize E-mail application. In the next chapter, the finding and testing of the proposed application will be discussed.

The evaluation was performed to determine the level of usability and operability of the system after the system has been developed; it is tested based on the list of requirements in chapter four for the system. The aim is to see the level of usability and operability of the prototype system. The evaluation and its results can be seen as in chapter four according to the system requirements. Selecting a suitable methodology is crucial in application development. Practicing in full discipline each activity in every phase is important to ensure the success of the system development. This would help in achieving a quality products and also helps to save time and cost in the production of the system.

CHAPTER FOUR

SYSTEM ARCHITECTURE AND DESIGN

4.1 Introduction

This chapter describes the automatic organizing of e-mail application architecture based on Intelligent Agents and designs the system using Prometheus Methodology.

Intelligent agents have been successfully used for personal assistants, intelligent user interfaces, and managing electronic mail and they represent a new type of software with significant prospective for a wide scale of Internet applications (Pivk and Gams, 2000) .

The Prometheus Design Tool (PDT) is a freely available (Padgham and Winikoff, 2004) tool, running under Java 1.5, which supports the software designer who is using the Prometheus methodology. PDT provides graphical support for the design phases of the methodology, allowing the designer to enter and edit diagrams and descriptors for entities. PDT also enforces certain constraints (e.g. that an action performed by an agent in the system overview diagram must also appear in the relevant agent overview diagram) and also checks the design for various consistency conditions. PDT also supports the design and development of intelligent multi-agent systems, and complements the Prometheus methodology (Padgham and Winikoff, 2004), although it can also be used with other approaches. It is based on specific agent entities such as goals, plans, percepts, actions and protocols, and provides both direction and support to software engineers. It also includes automated support for testing (Zhang, Thangarajah, and Padgham, 2007) and for partial code production.

4.1.1 System Requirements

E-mail has become an important element of any office automation system. Intelligent agents have been successfully used for personal assistants, intelligent user interfaces, and managing electronic mail and they represent a new type of software with significant prospective for a wide scale of Internet applications.

Based on our problem statement of organizing e-mail applications it conducted that the main goals of our system is to module the requirements of web based Automatic organization emails Application (System Architecture), to formulate and design the intelligent agent automatic organize E-mails application architecture (Prometheus Design Tool), to develop the intelligent agent automatic organize E-mails application system (Java Programming Language) and to test the proposed application using usability testing model (Usability Testing Model).

Our automatic organizing of e-mail application based on Intelligent Agents consists of three main agents: Control Agent (CA), Organizer Agent (OA) and Filtering Agent (FA). The Architecture of our system has been built by using two layers Agent Layer and Email Applications Layer.

4.2 System Architecture

The system architecture of automatic organizing of e-mail application based on Intelligent Agents of Control Agent (CA), Organizer Agent (OA), Filtering Agent (FA) and E-mail Applications shows in Figure 4.1 below:

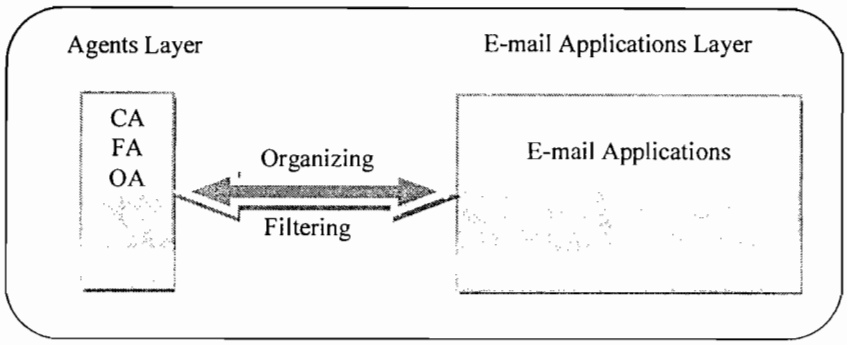

Figure 4.1: Automatic Organizing of E-mail application Architecture

The Architecture has been built by using two layers Agent Layer and Email Applications Layer. The functionality of those layers can be summarized as follows:

- Agent layer: This layer has three agents describe as follow:

- Control Agent (CA): is considered as the main and leader agent, this agent is acts as an effective bridge between the user and the rest of the agents. Such agents actively assist a user in operating an interactive interface, recording the messages and data shared among agents and also serves as a data access point for other agents, as well as users.

- Organizer Agent (OA): This agent uses to control some common problems faced by email users and what can be done to relieve the email headache. Nobody can control completely the volume of received emails. With the exception of subscriptions, most email is unrequested by the user. The Issue is not the volume, but the distractions left lingering in the inbox continually. How many emails received daily is irrelevant if the email one managed

- Filtering Agent (FA): Filtering Agent is processing e-mail for staging under specific scale. This refers to automatic processing of incoming messages frequently, but also

term applies to enter human intelligence, in addition to techniques for combating spam, and outgoing e-mail messages as well as those received. Filtering Agent is also as a production and it may pass the message unchanged through the delivery of user mailbox, redirecting a message for delivery elsewhere, or even throw away a letter

- E-mail Applications Layer: This layer is consist of e-mail applications that should be organized and filtered such as highlights the email that is important, distractions left lingering in the inbox continually, processing of incoming messages frequently, pass the message unchanged through the delivery of user mailbox and redirecting a message for delivery elsewhere.

4.3 Prometheus Overview and Design Based Prometheus Methodology

4.3.1 Prometheus Overview

Prometheus (Padgham and Winikoff, 2004), consists of three phases, as shown in Figure 4.2; system specification, architectural design, and detailed design. The first phase, system specification, where the system is specified using goals and scenarios; the system's interface to its environment is described in terms of actions, percepts and external data; and functionalities are defined. The second phase, architecture design, where agent types are identified; the system's overall structure is captured in a system overview diagram; and scenarios are developed into interaction protocols. The third phase, detailed design, where the details of each agent's internals are developed and defined in terms of capabilities, data, events and plans; process diagrams are used as a stepping stone between interaction protocols and plans. But the use of the JACK development environment is strongly recommended because both Prometheus and JACK are oriented toward BDI agent. Prometheus

development tool PDT provided an option to the developer to automatically generate JACK skeleton java code.

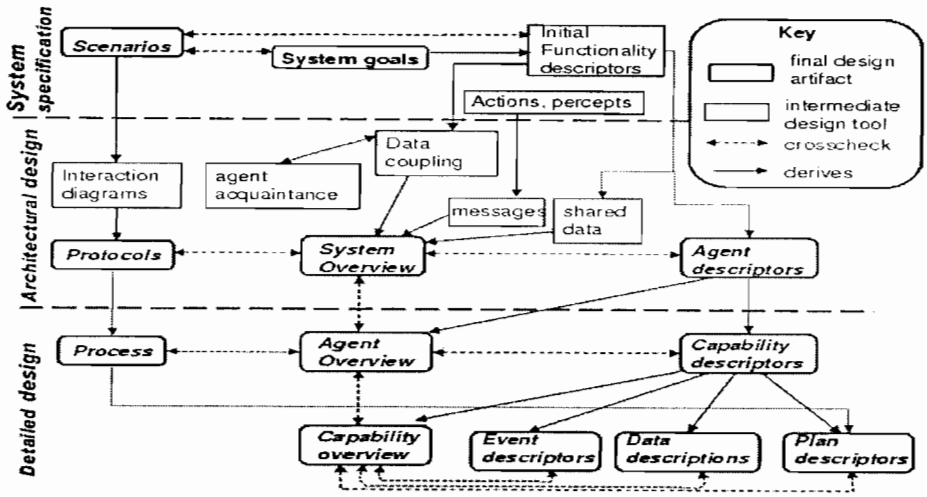

Figure 4.2: The Phases of the Prometheus methodology

4.3.1.1 System Specification Phase

The system specification phase focus on the analysis techniques. For the purpose of clarity, some low level scenario details are ignored in this description to instead concentrate on the big picture. The system specification phase focuses on system requirement definition to capture the system goals and sub-goals. The system goals are the centre construct of the system specification and are fundamental to AOS. The goals are systematically captured by searching for intentional words in the initial system documents. Once the main goals are identified, the other goals and sub-goals can emerge by using, refinement techniques (asking 'how?' and "why").

4.3.1.2 Architecture Design Phase

The architecture design phase will use the system specification artefacts to build the system architecture. The system architecture will be developed in three main steps. In the first step,

the application agent types are specified; in the second step, the system interactions are specified, in the third step, the system overviews are designed.

4.3.1.2.1 Specification of Agent Types:

The objective of this step is to identify the types of agents embraced by the required application. During step one; agent descriptors will also be developed. This objective will be reached through the implementation of low coupling and highly cohesion principals in the diagram of system functionalities. The techniques are centre around the relationships between the functionalities and data related to these functionalities. First, the data coupling diagram is built then the mostly related functionality is grouped in respect to the data relationship. The simple, concept to follow in grouping is to find if the group elements are associated with each other. Then the situation is read from a cohesiveness perspective to determine if a simple name (agent name) can be given. To review the agent coupling, the agent acquaintance diagram is developed. The acquaintance diagram will validate the type of agents involved in the application, and ensure that there is a loosely coupling association between the agents. The last step in the agent type specification is to print the agent descriptors.

4.3.1.2.2 Developing System Interactions:

Specifying the system interaction (interactions between agents) is the second step of the architecture design phase. The purpose of this step is to capture the dynamic aspects of the system, by developing interaction diagrams from a scenario, generalizing interaction diagrams to interaction protocols then developing protocol and messages descriptors. Prometheus Development Tool (PDT) has the capability to compile the protocol scripts

allocated in the system overview design and then generate the protocol diagram automatically.

4.3.1.3 Detailed Design Phase

Prometheus phases are integrated with each other. The detailed design phase uses the system architecture artefacts and develops two main aspects: first the internal individual agent capabilities and process; second the capabilities, plan and events analysis.

4.3.1.3.1 Capabilities:

The first step in the detailed design is to compile the agent descriptor and agent capabilities to develop the agent overview diagram developed as an example using PDT detailed design process. PDT has the ability to validate each design entity dynamically while the development process is running.

4.3.1.3.2 Process Specification:

The next step in building the individual agent is to identify the internal process specification of a single agent and specify its activities structure. Prometheus does borrow agent UML (AUML) activity diagram notation to present the process specifications. This means PDT does not provide any support to the process diagram. However, the best method to start building this task is to look into the protocols involved in the agent structure, the scenarios developed and the goals of the agent.

4.3.1.3.3 Capabilities Overview Diagram:

The last milestone in the detailed design phase is to turn the analysis artefacts into the implementation platform and achieve Prometheus agent architecture, which is based on the concept Belief-Desire-Intention (BDI). This will enforce the analysis process to focus on the internal structure of the system capabilities. Each capability is then decomposed into its lower level and the set of plans that provide the details of how to achieve the goals retrieved.

4.3.1.4 Design Based on Prometheus Methodology

4.3.1.4.1 System Specification

4.3.1.4.1.1 Goals

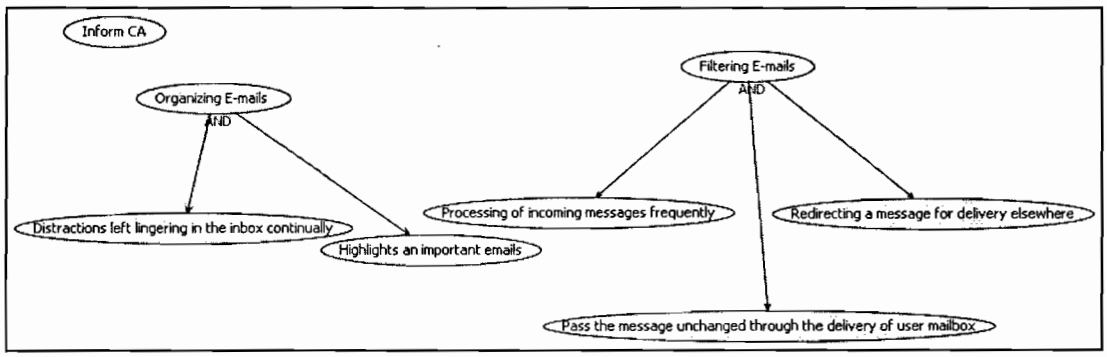

Figure 4.3: Goals

There are two main goals for the agents, and how they are achieved, are described as follows:

1. Organizing E-mails

   For this goal, OA shall be able to (sub-goals):

   a. Highlights an important emails

   b. Distractions left lingering in the inbox continually

2. Filtering E-mails

For this goal, FA shall be able to (sub-goals):

a. Processing of incoming messages frequently

b. Pass the message unchanged through the delivery of user mailbox

c. Redirecting a message for delivery elsewhere

4.3.1.4.1.2 Scenarios

Three different scenarios are identified, as follows:

1. Organizing E-mails

This represents when OA comes to organize e-mails

Scenario Organizing E-mails scenario

Name	Organizing E-mails scenario
Description	
Priority	Not Specified
Actors	
Initiated by	System
Trigger	

Steps

#	Type	Name	Role	Description	Data used	Data produced
1	Goal	Highlights an important emails		This represents when OA comes to organize e-mails		
2	Goal	Distractions left lingering in the inbox continually		This represents when OA comes to organize e-mails		
3	Action	Organize the emails application		This represents when OA comes to organize e-mails		
4	Goal	Inform CA		From scenario		

Variation

Figure 4.4: OA Scenario

2. Filtering E-mails

This represents when FA comes to filtering e-mails

Scenario Filtering E-mails scenario

Name	Filtering E-mails scenario						
Description							
Priority	Not Specified						
Actors							
Initiated by	System						
Trigger							
Steps	#	Type	Name	Role	Description	Data used	Data produced
	1	Goal	Pass the message unchanged through the delivery of user mailbox		This represents when FA comes to filtering e-mails		
	2	Goal	Processing of incoming messages frequently		This represents when FA comes to filtering e-mails		
	3	Goal	Redirecting a message for delivery elsewhere		This represents when FA comes to filtering e-mails		
	4	Action	Filtering the emails application		This represents when FA comes to filtering e-mails		
	5	Goal	Inform CA		From scenario		
Variation							

Figure 4.5: FA Scenario

4.3.1.4.1.3 System Roles

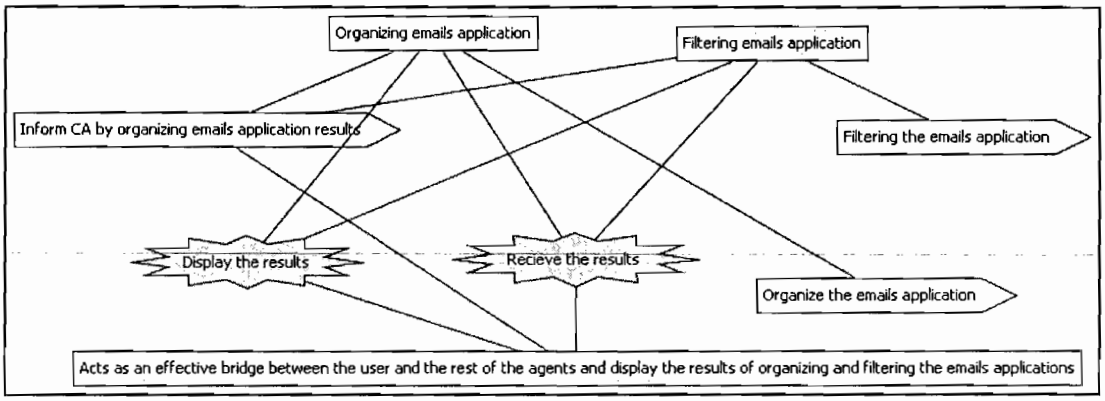

Figure 4.6: System Roles

Based on the different functionality/scenarios, different roles may be extrapolated as above.

4.3.1.4.2 Architectural Design

4.3.1.4.2.1 Data Coupling Diagram

Since we are not storing the data, segregation for agents shall be based on Agent Role Coupling, as below:

4.3.1.4.2.2 Agent Role Coupling Diagram

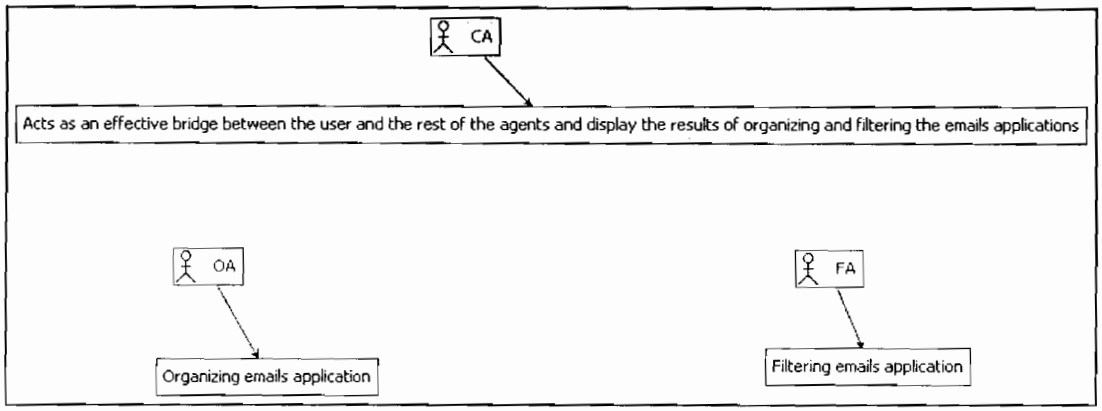

Figure 4.7: Agent Role Coupling Diagram

Based on the roles identified earlier, it is envisaged that five secure agents are required for the system to work efficiently. The description of the above agents shall be described in the Implementation section.

4.3.1.4.2.3 Agent Acquaintance Diagram

In term of collaboration and interaction between agents, the links between agents are as shown in the above Agent Acquaintance Diagram. In this case, the most active agent is CA, which serves as effective bridge between agents.

4.3.1.4.2.4 System Overview Diagram

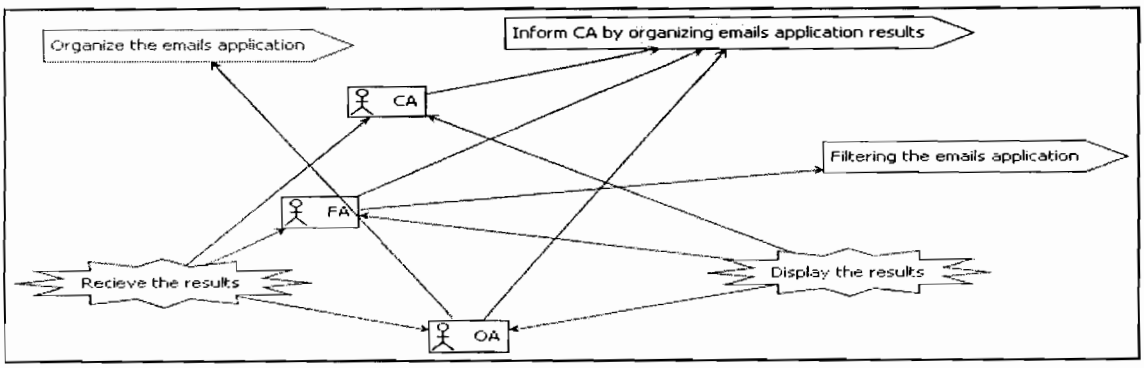

Figure 4.8: System Overview Diagram

To explain in detail the functionality of each agent, the above System Overview Diagram shall be used. The above identifies the Scenarios, the Agents, the Data, the Actions and the messages that are used by all Agents.

4.3.1.4.3 Detailed Agent Design

Below is the detail design for each agent:

4.3.1.4.3.1 Control Agent (CA)

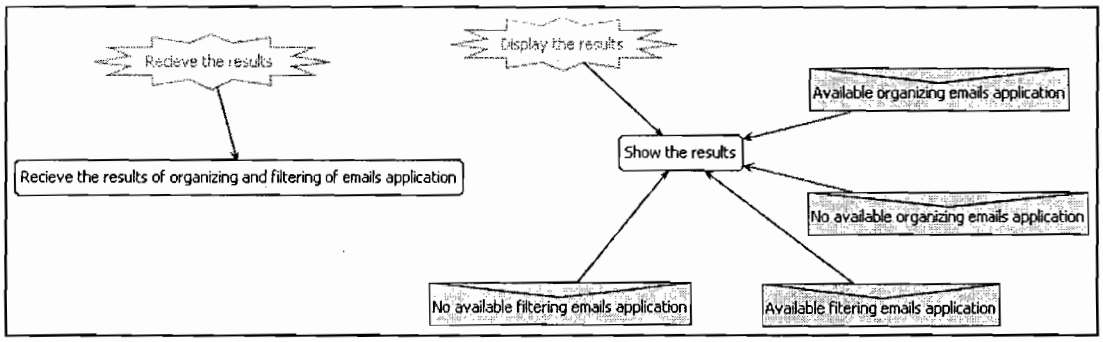

Figure 4.9: CA Detailed Design

4.3.1.4.3.2 Organizer Agent (OA)

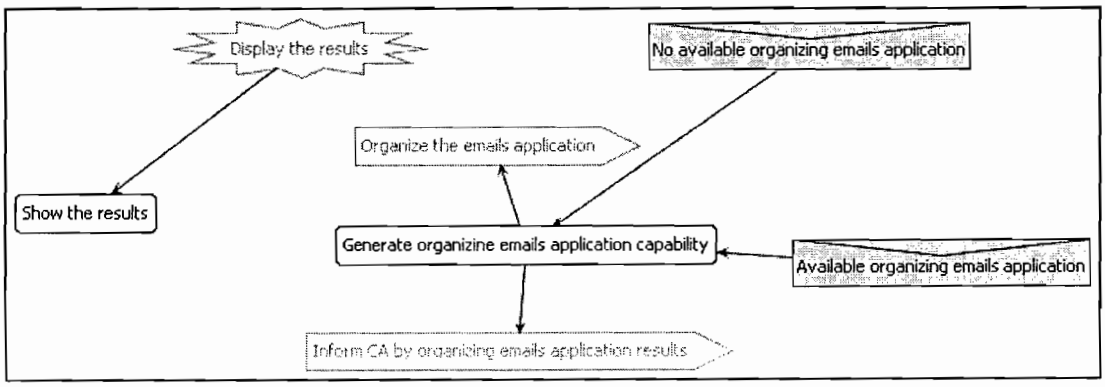

Figure 4.10: OA Detailed Design

4.3.1.4.3.3 Filtering Agent (FA)

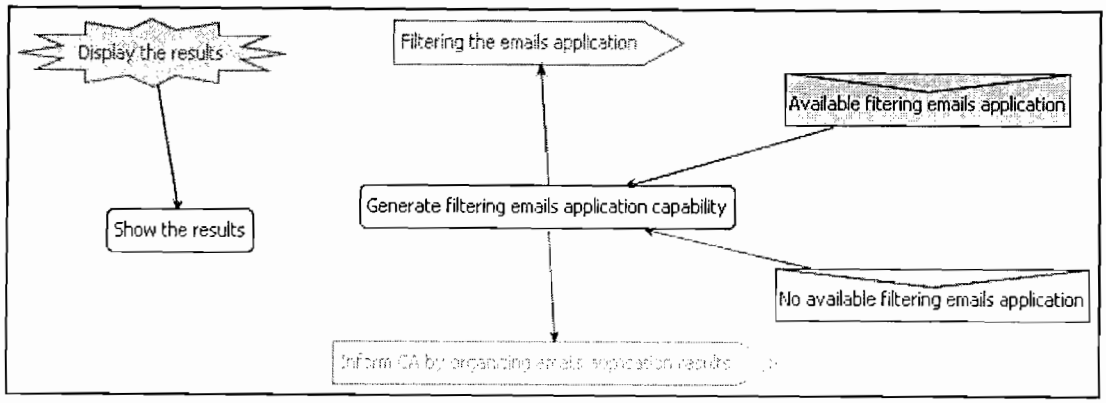

Figure 4.11: FA Detailed Design

4.4 System Development

In our architecture, we proposed three types of agents: Control Agent (CA), Organize Agent (OA) and Filter Agent (FA). Our automated organize emails application based on intelligent agent techniques architecture have been developed using JADE software.

The system is analyzed, designed, and implemented based on FIPA-compliant JADE platform. Each agent code is Consist of two main parts The "SetUp" method and the behaviors. The actual job an agent has to do is typically carried out within “behaviours”, as SetUp is coming up with initial Settings.

The interactions between the agents are implemented based on ACL_FIPA Communication Protocol. The primary features of FIPA ACL are the possibility of using different content languages and the management of conversations through predefined interaction protocols. A FIPA-ACL message contains a set of one or more message parameters. Precisely which parameters are needed for effective agent communication will vary according to the situation;

the only parameter that is mandatory in all ACL messages is the per-formative, although it is expected that most ACL messages will also contain sender, receiver and content parameters.

4.4.1 System Development Samples

4.4.1.1 Sample of the acl message transferred in the system

request recieved in Control_Agent is :(REQUEST

:receiver (set (agent-identifier :name Control_Agent@SAMI:1099/JADE))

:content "5/8/2/7/7"

)

request Forwarded to Inst_Organize_Agent: (PROPAGATE

:sender (agent-identifier :name Control_Agent@SAMI:1099/JADE :addresses (sequence http://SAMI:7778/acc http://SAMI:2634/acc http://SAMI:2636/acc http://SAMI:2638/acc http://SAMI:2640/acc http://SAMI:2642/acc http://SAMI:2644/acc))

:receiver (set (agent-identifier :name Organize_Agent@SAMI:1099/JADE))

:content "5/8/2/7/7"

)

4.4.1.2 User Interfaces

System user may request for organizing and filtering emails application resources via the following parameters, shown here for simulation:

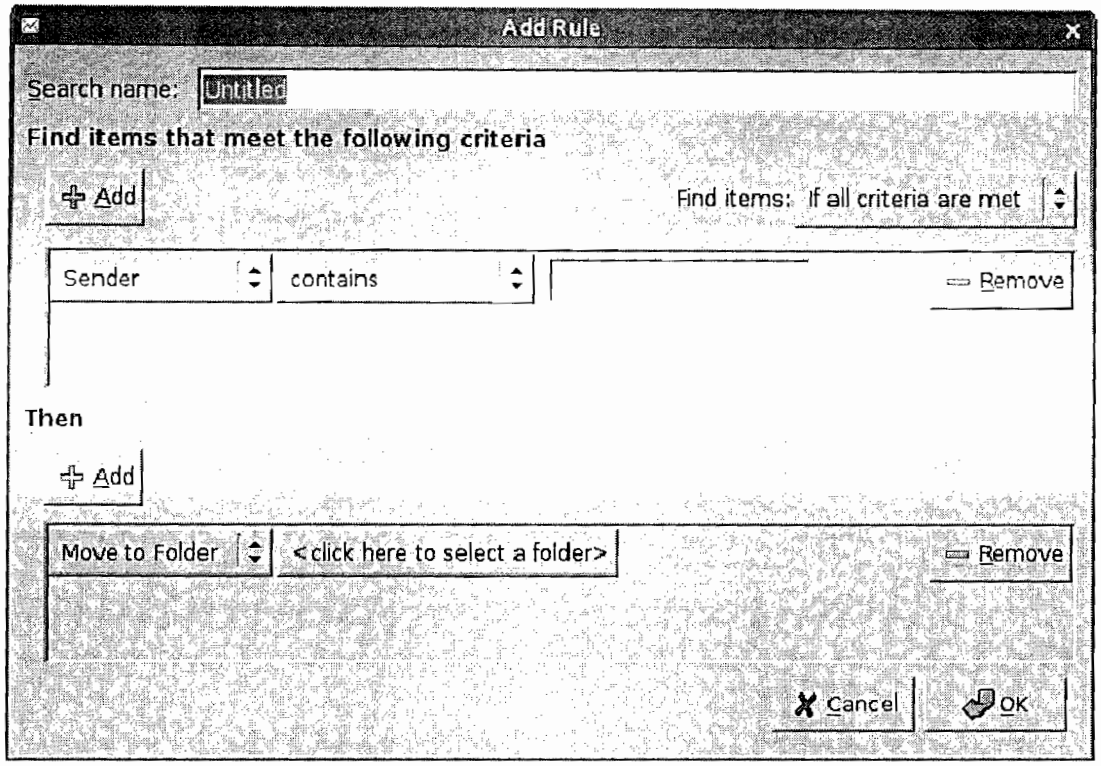

Figure 4.12: Add Rule of Organizing emails application

In the Create Folder dialog box, make sure Inbox is selected and then enter the name of the new folder you want to create. For example, in the image below, I am creating a new folder for all emails from my friends as illustrated in figure 4.13 below.

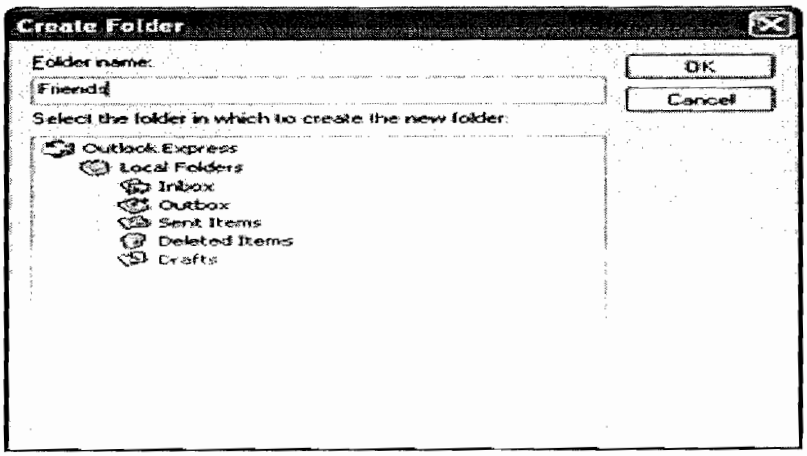

Figure 4.13: Create Folder dialog box

Go to "Tool" > "Message Rules" > "Mail". Click on the "New" button which opens the "New Mail Rule" dialog box. Select the first Condition - "Where the form line contains people" - and the first Action - "Move it to the specified folder" (Refer image below) as illustrated in figure 4.14 below.

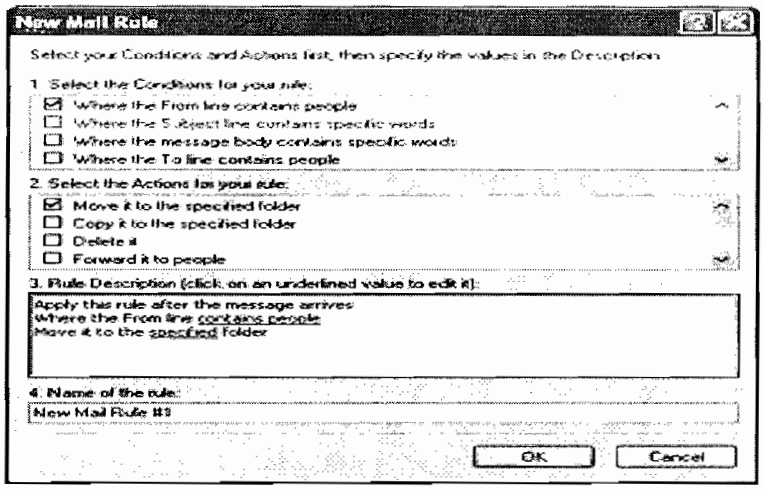

Figure 4.14: Create New Mail Rule

In the Create Rule box that opens up, you can select one or more conditions and the follow through actions by checking the boxes. As shown, you can screen the email by sender address (or distribution list), subject and/or recipient. You can also set a sound alert or a desktop *New Item Alert* for the incoming mail. To move the email to a specific folder, checkmark *Move the item to folder.* Click on the *Select folder* button to select the folder or click on *New* for a new one as illustrated in figure 4.15 below.

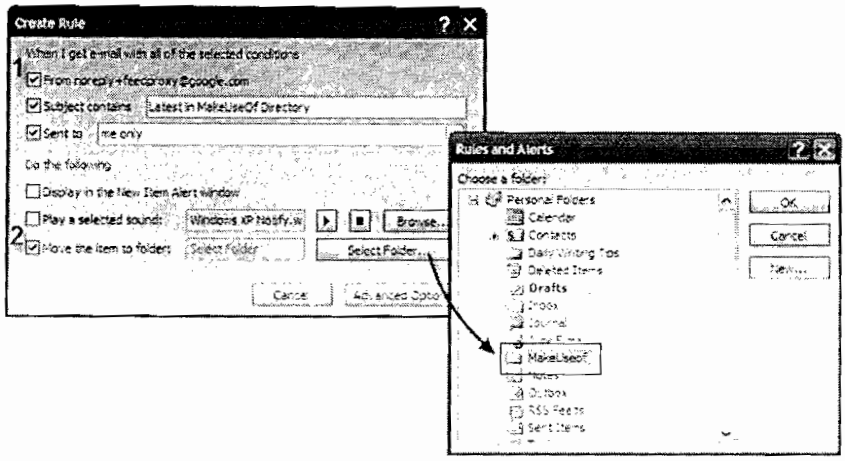

Figure 4.15: Create Rule box that opens up

The rules setup concludes at the final screen where you can specify a descriptive name for the rule, turn it on and review it for any changes as illustrated in figure 4.16 below.

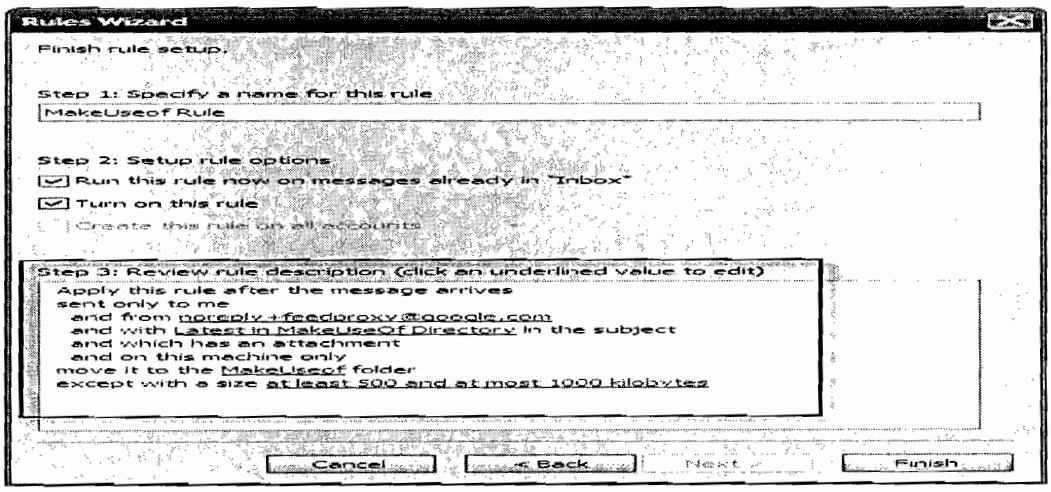

Figure 4.16: Create descriptive name for the rule

Further fine-tune the rule if you want by clicking on *Advanced Options*. The advanced option wizard lets you select other conditions, select a range of actions to perform on them and select exceptions to the rules if any as illustrated in figure 4.17 below.

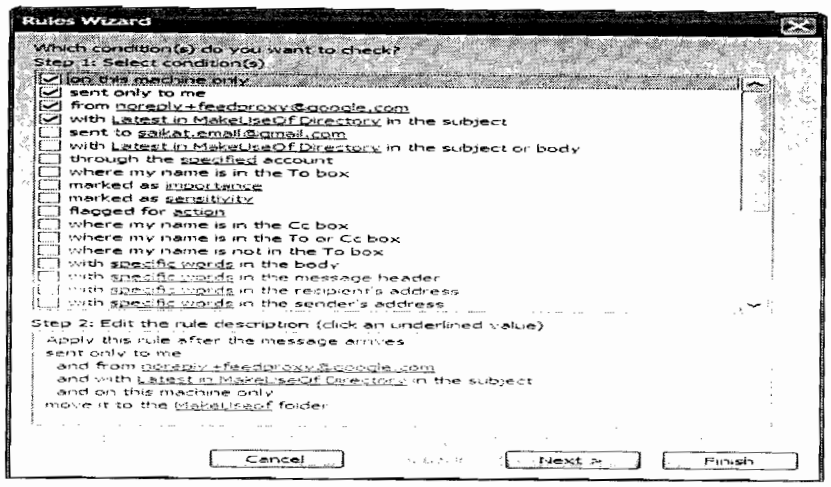

Figure 4.17: Advanced Options Screen

4.4.1.3 Agent Simulation

A log file is kept to keep track of agent's activities. The sample log is as below:

init:
deps-jar:
...
INFO: ----------
Agent container Main-Container@SAMI is ready.

...
INFO: Service jade.core.management.Agent.Management initialized
INFO: --- Email <ClsName0> ALIVE --- **** (USER EMAILS)
Mar 14, 2008 9:43:24 AM jade.mtp.http.HTTPServer <init>
INFO: HTTP-MTP Using XML parser
com.sun.org.apache.xerces.internal.jaxp.SAXParserImpl$JAXPSAXParser
...
INFO: ----------
Agent container ClsName0@SAMI is ready. ****

Mar 14, 2008 9:43:24 AM jade.core.Runtime beginContainer
...
INFO: --- Email <ClsName1> ALIVE --- **** USER EMAILS
Mar 14, 2008 9:43:24 AM jade.mtp.http.HTTPServer <init>
...
INFO: ----------
Agent container ClsName5@SAMI is ready.
---
request recieved in Control_Agent is :(REQUEST **** (Performatives)
:receiver (set (agent-identifier :name Control_Agent@SAMI:1099/JADE))

:content "3/6/2/4/7"
)
FA STARTED
request Forwarded to Inst_FA: (PROPAGATE
:sender (agent-identifier :name Control_Agent@SAMI:1099/JADE :addresses (sequence http://SAMI:7778/acc http://SAMI:2260/acc http://SAMI:2262/acc http://SAMI:2264/acc http://SAMI:2266/acc http://SAMI:2268/acc http://SAMI:2270/acc))
:receiver (set (agent-identifier :name FA@SAMI:1099/JADE))
:content "3/6/2/4/7"
)
CA Request Recieved : (PROPAGATE
:sender (agent-identifier :name Control_Agent@SAMI:1099/JADE :addresses (sequence http://SAMI:7778/acc http://SAMI:2260/acc http://SAMI:2262/acc http://SAMI:2264/acc http://SAMI:2266/acc http://SAMI:2268/acc http://SAMI:2270/acc))
:receiver (set (agent-identifier :name CA@SAMI:1099/JADE))
:content "3/6/2/4/7"
)
OA RECEIVED Request
AORBA Request Recieved : (Search
:sender (agent-identifier :name Control_Agent@SAMI:1099/JADE :addresses (sequence http://SAMI:7778/acc http://SAMI:2260/acc http://SAMI:2262/acc http://SAMI:2264/acc http://SAMI:2266/acc http://SAMI:2268/acc http://SAMI:2270/acc))
:receiver (set (agent-identifier :name OA@SAMI:1099/JADE))
:content "3/6/2/4/7")

4.4.2 Conclusion

It can be concluded that based on the characteristics of emails application based intelligent agent architecture supports high level of organizing and filtering the emails application using intelligence agents. Our implementation of this architecture will be fully focused on building the agents and not inclusive of the network simulation.

The system is based on intelligent agent architecture, consisting of CA (Control Agent), OA (Organize Agent) and FA (Filter Agent). The agent is designed using Prometheus methodology and developed using FIPA compliant JADE agent framework.

4.5 Summary

It can be concluded that based on the characteristics of emails application, organizing and filtering based intelligent agent architecture supports higher organizing and filtering irrespective of its location and resolve a task based on planning algorithms using intelligence agents. Our implementation of this architecture will be fully focused on building the agents and not inclusive of the network simulation.

The system is based on Intelligent Agents, consisting of OA, FA and one leader and control interaction agents CA (Control Agent). The agent is designed using Prometheus methodology and will be developed using FIPA compliant JADE agent framework in next chapter.

CHAPTER FIVE

RESULT AND DISCUSSION

5.1 Introduction

This chapter highlights the main finding of this research and survey result conducted on the complete system, whether the model fulfils the characteristics of the our intelligent agent for automatic organizing and filtering emails application by using Usability evaluating questions and prove our system is a useful support system. It also discusses the strengths and limitation of our intelligent agent system by defines it in the three main criteria of the usability model.

The survey also conducted questions related to our intelligent agent system to refresh the participant information about how to handle the interpretation of the term our intelligent agent system.

5.2 Result

As the experiment that has been conducted and described in the methodology (Chapter 3). The report starts with an overview of data collected by analyzing trends. Correlation was measured by Pearson's Correlation process of SPSS 16.0, the Quantitative and Qualitative analysis will describe. The Post-Survey Questionnaire for both Quantitative and Qualitative. Satisfaction is a multi-dimensional construct. This study applies evaluate our intelligent agent for automatic organizing and filtering emails application by using Usability evaluating questions and prove our system is a useful support system.

5.2.1 Usability Evaluation System

Several types of data were collected to assess user's performance and user's perceptions of negotiating the system, as follows:

- ❖ Effectiveness was measured by the number of tasks successfully completed.
- ❖ Efficiency was measured by the amount of time taken to complete all tasks.
- ❖ Satisfaction was measured by a rating scale for several satisfaction elements.

In addition, we examined selected features of the normal lotus notes system to determine their effectiveness. Tasks were deemed to be either completed or not completed.

From the data analysis considered that, TASKA, TASKB, TASKC, and TASKD indicated Pre-Survey Quantitative and Qualitative analysis and Post-Survey Quantitative analysis and Qualitative analysis respectively. Any task contained 9 questions (tasks).

5.2.1.1 Effectiveness

5.2.1.1.1 Completed Tasks Successfully

Table 5.1, Table 5.2 and Table 5.3 are shows the percentage of successful task completion and descriptive statistics of TASKA. From Tables 5.1 below, we observed the Q2 and Q6 are completed answered successfully (100%) and the others questions got more than 60%.

From Table 5.2 below, the descriptive statistic analysis for TASKA the measuring of the Mean gave 4.6667 out of 6.44. Figure 5.1 below shows the TASKA Success Rate for Individual Task.

Table 5.1: TASKA Successfully Completed

Question no.	Task type	Number of Participants (N)	Number of Participants solved the question correctly	% of task's successful completion
Q1	Is organizing or filtering emails application knowledge a routine and like any other daily habits for the emails application's employees?	10	7	70%
Q2	Are the emails application's employees co-operative and helpful when asked for some information or advice?	10	10	100%
Q3	Is organizing or filtering emails application seen as strength and knowledge hoarding as a weakness?	10	9	90%
Q4	Is good knowledge management behavior like organizing or filtering emails application knowledge actively promoted on a day-to-day basis?	10	6	60%
Q5	Are people in the organizing or filtering emails application organization aware of the need to proactively manage emails application's knowledge assets?	10	9	90%
Q6	Do people at all levels in the organizing or filtering emails application organization participate in some kind of a community or communities of practice?	10	10	100%
Q7	Is there top management representation for organizing or filtering emails application?	10	9	90%
Q8	Is knowledge management a formal function area in the organizing or filtering emails application organization?	10	9	90%
Q9	Are the teams in the organizing or filtering emails application organization effective and self managed teams composed of individuals capable of learning from each other?	10	7	70%

Table 5.2: Descriptive Statistics for TASKA1...TASKA9

Question (Task)	N	Minimum	Maximum	Mean	Std. Deviation
TASKA1	10	2	6	4.80	1.549
TASKA2	10	4	6	5.10	0.568
TASKA3	10	1	6	4.60	1.350
TASKA4	10	2	6	4.10	1.287
TASKA5	10	2	6	4.80	1.135
TASKA6	10	4	5	4.70	0.483
TASKA7	10	3	5	4.40	0.699
TASKA8	10	3	6	5.10	0.994
TASKA9	10	2	6	4.40	1.350
Valid N (listwise)	10				

Table 5.3: Descriptive Statistics for TASKA

TASKA	N	Minimum	Maximum	Mean	Std. Deviation
TASKA	10	3.33	5.44	4.6667	0.62416
Valid N (listwise)	10				

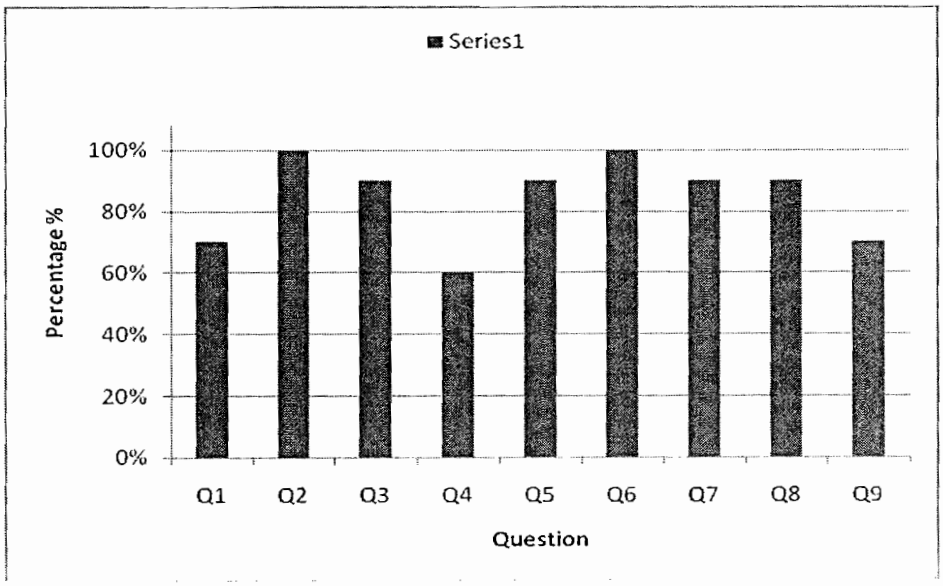

Figure 5.1: TASKA Success Rates for Individual Task

Table 6.4, Table 5.5 and Table 5.6 are shows the percentage of successful task completion and descriptive statistics of TASKB. From Tables 5.4 below, we observed the Q1 and Q8 are

completed answered successfully (100%) and the others questions got more than 50%. From Table 6.5 below, the descriptive statistic analysis for TASKB the measuring of the Mean gave 1.70 out of 2.00. Figure 5.2 below shows the TASKB Success Rate for Individual Task.

Table 5.4: TASKB Successfully Completed

Question no.	Task type	Number of Participants (N)	Number of Participants solved the question correctly	% of task's successful completion
Q1	Do the organizing or filtering emails application employees share their knowledge?	10	10	100%
Q2	Is the intranet used to organizing or filtering emails application knowledge in an informal manner (non-routine, personal and unstructured way)?	10	8	80%
Q3	Do workplace settings and format of meetings encourage informal knowledge exchange?	10	6	60%
Q4	Are there incentives given for knowledge contribution, exchange or on organizing or filtering emails application knowledge in your firm?	10	8	80%
Q5	Is the support from executive management to organizing or filtering emails application \ knowledge VISIBLE?	10	5	50%
Q6	Are there specific organizing or filtering emails application knowledge roles identified and assigned?	10	5	50%
Q7	Are all senior managers and professionals trained in organizing or filtering emails application techniques?	10	9	90%
Q8	Knowledge agents validated through peer or superior review	10	10	100%
Q9	Knowledge sharing across agents boundaries actively encouraged	10	6	60%

Table 5.5: Descriptive Statistics for TASKB1...TASKB9

Question (Task)	N	Minimum	Maximum	Mean	Std. Deviation
TASKB1	10	1	1	1.00	0.000
TASKB2	10	1	2	1.20	0.422
TASKB3	10	1	2	1.60	0.516
TASKB4	10	1	2	1.80	0.422
TASKB5	10	1	2	1.50	0.527
TASKB6	10	1	2	1.50	0.527
TASKB7	10	1	2	1.90	0.316
TASKB8	10	2	2	2.00	0.000
TASKB9	10	1	2	1.60	0.516
Valid N (listwise)	10				

Table 5.6: Descriptive Statistics for TASKB

TASKB	N	Minimum	Maximum	Mean	Std. Deviation
TASKB	10	1.00	2.00	1.70	0.79196
Valid N (listwise)	10				

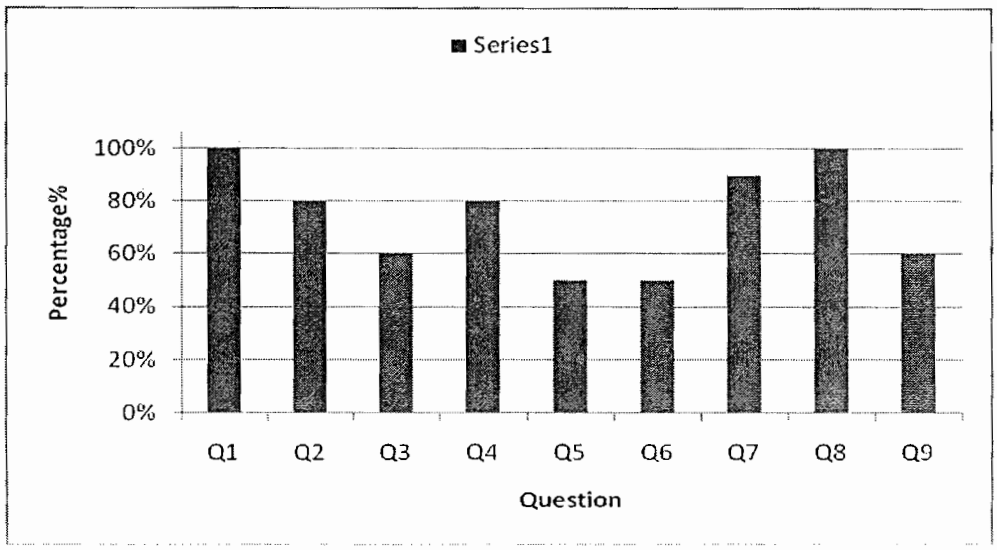

Figure 5.2: TASKB Success Rates for Individual Task

Table 5.7, Table 5.8 and Table 5.9 are shows the percentage of successful task completion and descriptive statistics of TASKC. From Table 6.7 below, we observed the Q2, Q6, Q8 and Q9 are completed answered successfully (100%) and the others questions got more than 70%. From Table 6.8 below, the descriptive statistic analysis for TASKC the measuring of the Mean gave 3.8556 out of 4.67. Figure 5.3 below shows the TASKC Success Rate for Individual Task

Table 5.7: TASKC Successfully Completed

Question no.	Task type	Number of Participants (N)	Number of Participants solved the question correctly	% of task's successful completion
Q1	Is it possible to change organize or filter agent schedule.	10	7	70%
Q2	We can run organize or filter agent "After new mail arrives" and "Before new mail arrives".	10	10	100%
Q3	Organize or filter agent option will appear in the current mail file.	10	6	60%
Q4	One of our users left the office without enabling organizes or filters agent. We can enable it for him or her.	10	7	70%
Q5	To customize the "Welcome Back" message, the "Disable Reminder" message, or the default wording of organize or filter e-mail notifications sent to all senders of e-mail.	10	9	90%
Q6	Organize or filter agent work in a clustered environment.	10	10	100%
Q7	We can enable organize or filter agent for leaving "Today" instead of the recommended "Tomorrow" or another date in the future.	10	8	80%

Q8	Organize or filter agent work in a clustered environment.	10	10	100%
Q9	We can enable organize or filter agent for leaving "Today" instead of the recommended "Tomorrow" or another date.	10	10	100%

Table 5.8: Descriptive Statistics for TASKC1...TASKC9

Question (Task)	N	Minimum	Maximum	Mean	Std. Deviation
TASKC1	10	3	5	4.00	0.816
TASKC2	10	4	6	5.10	0.876
TASKC3	10	1	5	2.90	1.853
TASKC4	10	1	5	2.70	1.337
TASKC5	10	1	4	2.60	0.843
TASKC6	10	1	3	2.30	0.823
TASKC7	10	2	5	4.20	1.033
TASKC8	10	4	6	5.40	0.699
TASKC9	10	4	6	5.50	0.707
Valid N (listwise)	10				

Table 5.9: Descriptive Statistics for TASKC

TASKC	N	Minimum	Maximum	Mean	Std. Deviation
TASKC	10	3.22	4.67	3.8556	0.40589
Valid N (listwise)	10				

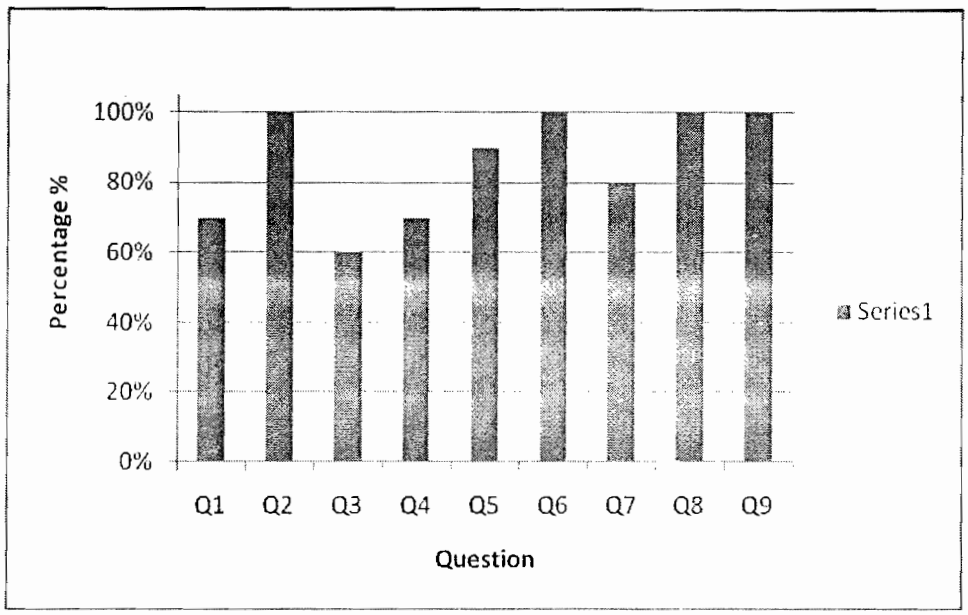

Figure 5.3: TASKC Success Rates for Individual Task

Table 5.10, Table 5.11 and Table 5.12 are shows the percentage of successful task completion and descriptive statistics of TASKD. From Table 5.10 below, we observed the Q1, Q5 and Q9 are completed answered successfully (100%) and the others questions got more than 60%. From Table 5.11 below, the descriptive statistic analysis for TASKD the measuring of the Mean gave 1.70 out of 2.00. Figure 5.4 below shows the TASKC Success Rate for Individual Task

Table 5.10: TASKD Successfully Completed

Question no.	Task type	Number of Participants (N)	Number of Participants solved the question correctly	% of task's successful completion
Q1	We can set the organizing agent for an absence period of a half day or a few hours.	10	10	100%

Q2	We can set the filtering agent for an absence period of a half day or a few hours.	10	9	90%
Q3	Whenever we receive a warning in Designer while attempting to save an agent…….etc	10	6	60%
Q4	"Do you know why I get 'Object variable not set'?"…etc	10	6	60%
Q5	If these tips don't help you figure it out on your own, when…..	10	10	100%
Q6	It is possible to pass parameters between agents.	10	7	70%
Q7	It is easy to console commands for organize from organize agent.	10	9	90%
Q8	It is easy to console commands for filter from filter agent.	10	9	90%
Q9	Does the agents that applied will help the users of the system	10	10	100%

Table 5.11: Descriptive Statistics for TASKD1…TASKD9

Question (TASK)	N	Minimum	Maximum	Mean	Std. Deviation
TASKD1	10	1	1	1.00	0.000
TASKD2	10	1	2	1.10	0.316
TASKD3	10	1	2	1.40	0.516
TASKD4	10	1	2	1.60	0.516
TASKD5	10	1	1	1.00	0.000
TASKD6	10	1	2	1.70	0.483
TASKD7	10	1	2	1.10	0.316
TASKD8	10	1	2	1.10	0.316
TASKD9	10	1	1	1.00	0.000
Valid N (listwise)	10				

Table 5.12: Descriptive Statistics for TASKD

TASKD	N	Minimum	Maximum	Mean	Std. Deviation
TASKD	10	1.00	2.00	1.70	0.66667
Valid N (listwise)	10				

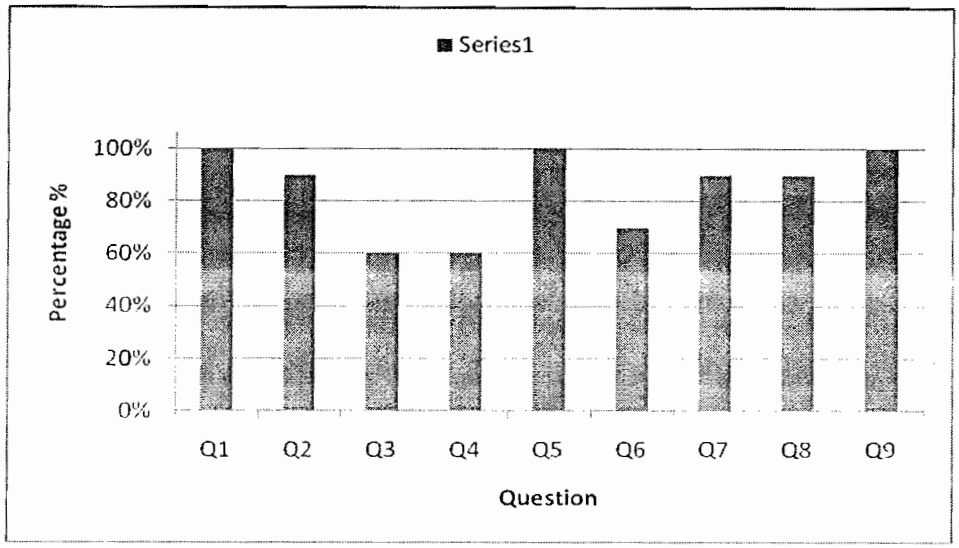

Figure 5.4: TASKD Success Rates for Individual Task

As we can notice all participants were able to complete all the tasks. For other tasks participants were able to complete in success percent ranging between (50% & 100%). The Successful task completion for the individual tasks is summarized in Figure 6.1, Figure 6.2, Figure 6.3 and Figure 6.4 for the participants. As we can see the average of successfully completion task are high is TASKC and TASKD, according to this results the successfully completion task that presented the effectiveness, achieved correctly. Moreover these results of the tasks successfully completed are high.

$$CV = SD*100/MEAN$$

Where, CV is coefficient variance and SD is standard deviation. If CV < 40%, it indicates high effectiveness of tasks successfully completed and accuracy. Therefore, we can certainly get value for the CV is less than 40% after dividing SD on the MEAN

5.2.1.2 Efficiency

Efficiency in this study is measured by how much time it takes to complete a task correctly. If the answer is wrong, the time spent. If a participant decides to give up a question, the time spent and the steps on the particular question are also not counted.

Completion time is the one factor used for measuring efficiency in this project. An average of 44 minutes and 3.5 seconds per participant was taken to complete the all tasks. However, there was much variation among the participants, for example, the fastest participant took only 18 minutes and the slowest took 37 minutes and 9 seconds which are about three times longer. Pearson's product-moment correlation analysis was conducted to see if the participants' completion time is related. The results showed that total completion time is independent, (see Figure 5.5, Figure 5.6, Figure 5.7 and Figure 5.8). Table 5.13, Table 5.14, Table 5.15 and Table 5.16 are indicates time used to complete the tasks for TASKA, TASKB, TASKC, and TASKD respectively.

Table 5.13: Time used to complete the task (TASKA)

Question no.	Task type	**Mean (task completion time)**
Q1	Is organizing or filtering emails application knowledge a routine and like any other daily habits for the emails application's employees?	**7**
Q2	Are the emails application's employees co-operative and helpful when asked for some information or advice?	**4.50**
Q3	Is organizing or filtering emails application seen as strength and knowledge hoarding as a weakness?	**9**
Q4	Is good knowledge management behavior like organizing or filtering emails application knowledge actively promoted on a day-to-day basis?	**1.40**
Q5	Are people in the organizing or filtering	**8**

	emails application organization aware of the need to proactively manage emails application's knowledge assets?	
Q6	Do people at all levels in the organizing or filtering emails application organization participate in some kind of a community or communities of practice?	**1.35**
Q7	Is there top management representation for organizing or filtering emails application?	**8**
Q8	Is knowledge management a formal function area in the organizing or filtering emails application organization?	**10**
Q9	Are the teams in the organizing or filtering emails application organization effective and self managed teams composed of individuals capable of learning from each other?	**9.75**

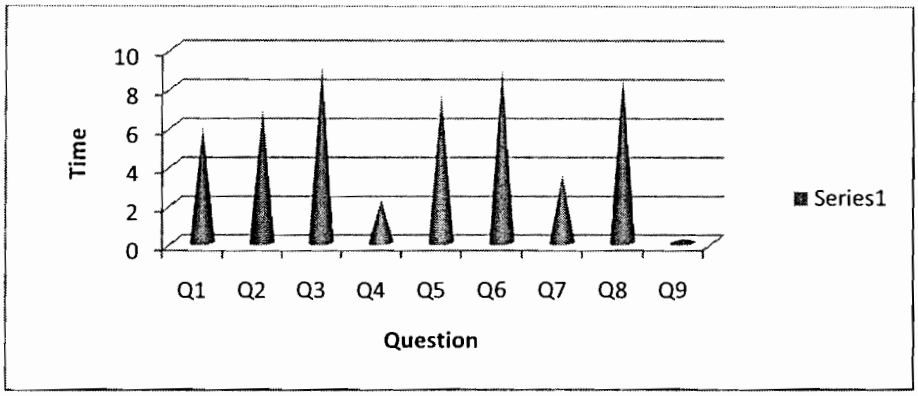

Figure 5.5: Time used to completed (TASKA)

Table 5.14: Time used to complete the task (TASKB)

Question no.	Task type	Mean (task completion time)
Q1	Do the organizing or filtering emails application employees share their knowledge?	**1.9**
Q2	Is the intranet used to organizing or filtering emails application knowledge in an informal manner (non-routine, personal and unstructured way)?	**5.9**
Q3	Do workplace settings and format of meetings encourage informal knowledge exchange?	**1.75**
Q4	Are there incentives given for knowledge contribution, exchange or on organizing or filtering emails application knowledge in your	**1.9**

	firm?	
Q5	Is the support from executive management to organizing or filtering emails application \ knowledge VISIBLE?	**4.45**
Q6	Are there specific organizing or filtering emails application knowledge roles identified and assigned?	**2.9**
Q7	Are all senior managers and professionals trained in organizing or filtering emails application techniques?	**9.85**
Q8	Knowledge agents validated through peer or superior review	**4.1**
Q9	Knowledge sharing across agents boundaries actively encouraged	**3.35**

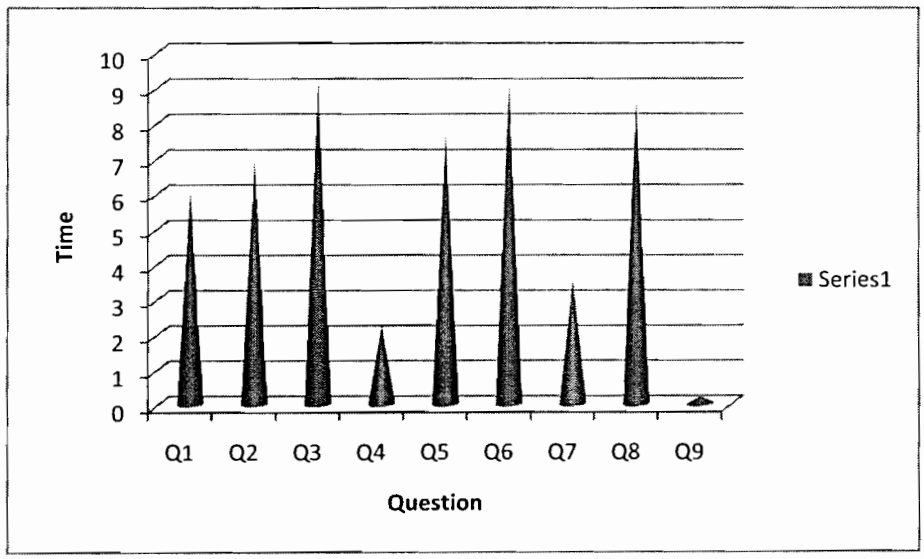

Figure 5.6: Time used to completed (TASKB)

From Figure 5.6 above, we observe Q1, Q2, Q3, Q5, Q6 and Q8 are taken long time from the participants and Q4, Q7 and Q9 are taken short time.

Table 5.15: Time used to complete the task (TASKC)

Question no.	Task type	Mean (task completion time)
Q1	Is it possible to change organize or filter agent schedule.	4.57
Q2	We can run organize or filter agent "After new mail arrives" and "Before new mail arrives".	6.5
Q3	Organize or filter agent option will appear in the current mail file.	4.5
Q4	One of our users left the office without enabling organizes or filters agent. We can enable it for him or her.	5.5
Q5	To customize the "Welcome Back" message, the "Disable Reminder" message, or the default wording of organize or filter e-mail notifications sent to all senders of e-mail.	7
Q6	Organize or filter agent work in a clustered environment.	8
Q7	We can enable organize or filter agent for leaving "Today" instead of the recommended "Tomorrow" or another date in the future.	9.15
Q8	Organize or filter agent work in a clustered environment.	9
Q9	We can enable organize or filter agent for leaving "Today" instead of the recommended "Tomorrow" or another date.	5

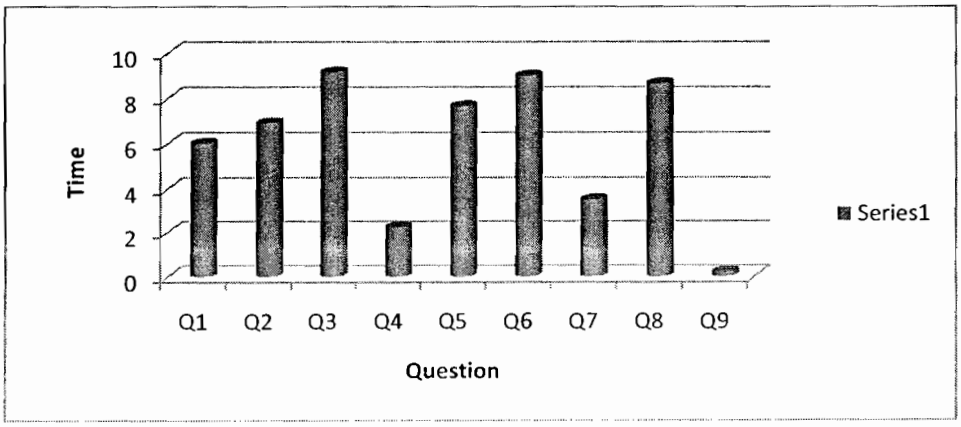

Figure 5.7: Time used to completed (TASKC)

Table 5.16: Time used to complete the task (TASKD)

Question no.	Task type	Mean (task completion time)
Q1	We can set the organizing agent for an absence period of a half day or a few hours.	6
Q2	We can set the filtering agent for an absence period of a half day or a few hours.	6.90
Q3	Whenever we receive a warning in Designer while attempting to save an agent…….etc	9.15
Q4	"Do you know why I get 'Object variable not set'?"…etc	2.22
Q5	If these tips don't help you figure it out on your own, when…..	7.65
Q6	It is possible to pass parameters between agents.	9
Q7	It is easy to console commands for organize from organize agent.	3.50
Q8	It is easy to console commands for filter from filter agent.	8.65
Q9	Does the agents that applied will help the users of the system	0.21

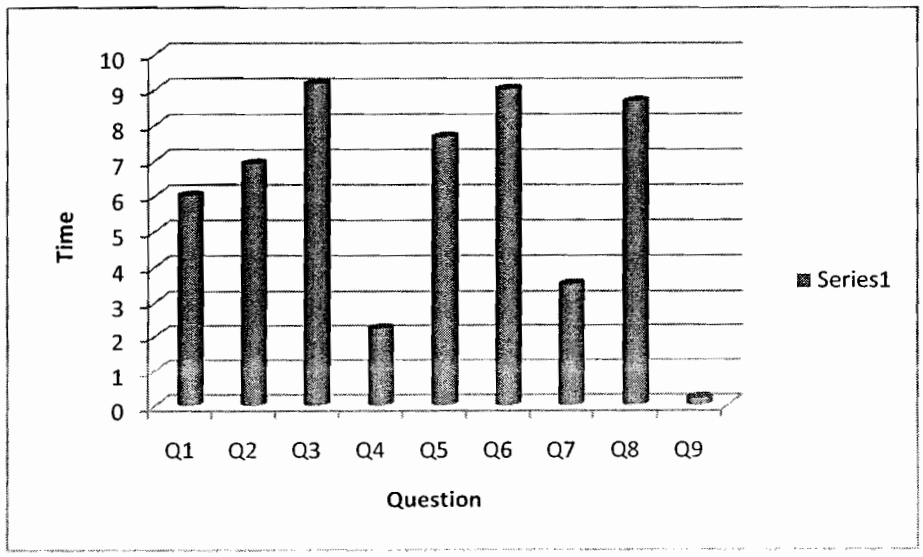

Figure 5.8: Time used to completed (TASKD)

As a result, efficiency was measured by evaluating completion time used in this survey by each participant. Participants who they were familiar with the systems in general tended to use less time to complete their tasks. When the participant knows how to get the answer, it takes them fewer time while when they don't know how to use the system, they take more time.

The time results will be used to find the relation between the effectiveness and efficiency and how the efficiency affects the effectiveness, by using the correlation statistic method, and also after obtaining the result we can know if the efficiency are archived or not. In this project and according to the result after applying the correlation, the efficiency is achieved (see Table 5.17, Table 5.18, Table 5.19 and Table 5.20).

5.2.1.3 Satisfaction

Participants Satisfaction measured by using the two scales (YES= participant agreed, NO= participant not agreed). According to the result below we can observe that the satisfaction for the participants were in moderate level. Table 6.17 below shows the participant satisfaction for TASKA, from the Table we observe that the Q2 and Q8 give high satisfaction (Mean=5.10) out of (Maximum =6) and Q6 give high satisfaction (Mean=4.70), and Q7 also give high satisfaction (Mean=4.40) out of (Maximum=5).

We observe all the participants feel satisfied with the system when they fail to perform the task correctly.

Tables 5.17 depict that participants feel less satisfied with the system when they fail to perform the task correctly. According to the analytical results more than 70% of participants were satisfied and the satisfaction were acceptable from their responses.

Table 5.17: Participant Satisfaction for TASKA

Question (Task)	N	Minimum	Maximum	Mean	Std. Deviation
TASKA1	10	2	6	4.80	1.549
TASKA2	10	4	6	5.10	0.568
TASKA3	10	1	6	4.60	1.350
TASKA4	10	2	6	4.10	1.287
TASKA5	10	2	6	4.80	1.135
TASKA6	10	4	5	4.70	0.483
TASKA7	10	3	5	4.40	0.699
TASKA8	10	3	6	5.10	0.994
TASKA9	10	2	6	4.40	1.350
Valid N (listwise)	10				

From Figure 6.9 below observe that all participants feel high satisfied in Q9, Q8, Q2, Q7, and Q1 and feel less satisfied in Q6.

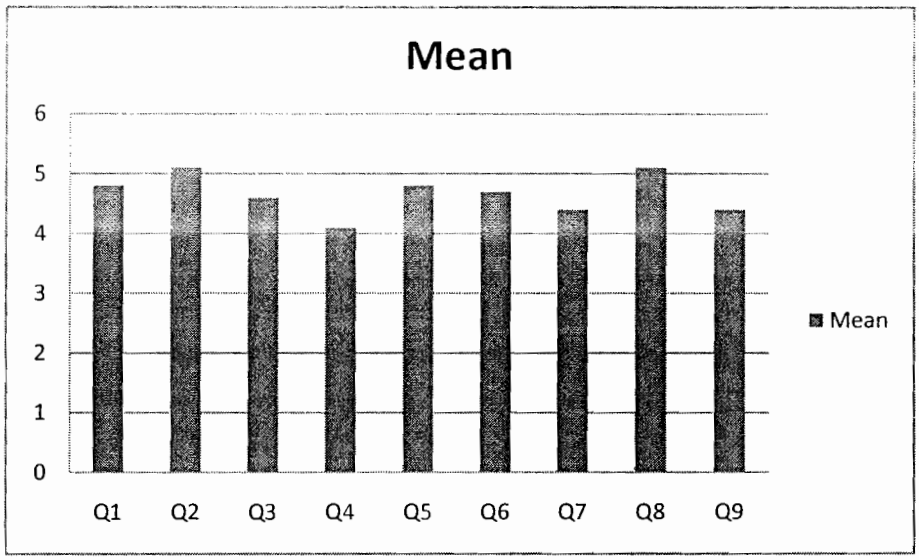

Figure 5.9: Participant satisfaction for TASKA

Table 5.19 below shows the participant satisfaction for TASKC. From the Table we observe that the Q8 give high satisfaction (Mean=5.40) and Q9 give high satisfaction (Mean=5.50) out of (Maximum =6) and Q7 give high satisfaction (Mean=4.20) out of (Maximum=5).

We observe 30% of participants feel less satisfied with the system when they fail to perform the task correctly.

Table 5.18 depict that participants feel less satisfied with the system when they fail to perform the task correctly. According to the analytical results more than 70% of participants were satisfied and the satisfaction were acceptable from their responses.

Table 5.18: Participant Satisfaction for TASKC

Question (Task)	N	Minimum	Maximum	Mean	Std. Deviation
TASKC1	10	3	5	4.00	0.816
TASKC2	10	4	6	5.10	0.876
TASKC3	10	1	5	2.90	1.853
TASKC4	10	1	5	2.70	1.337
TASKC5	10	1	4	2.60	0.843
TASKC6	10	1	3	2.30	0.823
TASKC7	10	2	5	4.20	1.033
TASKC8	10	4	6	5.40	0.699
TASKC9	10	4	6	5.50	0.707
Valid N (listwise)	10				

From Figure 5.10 below observe that all participants feel high satisfied in Q9, Q8, Q2, Q7, and Q1 and feel less satisfied in Q6.

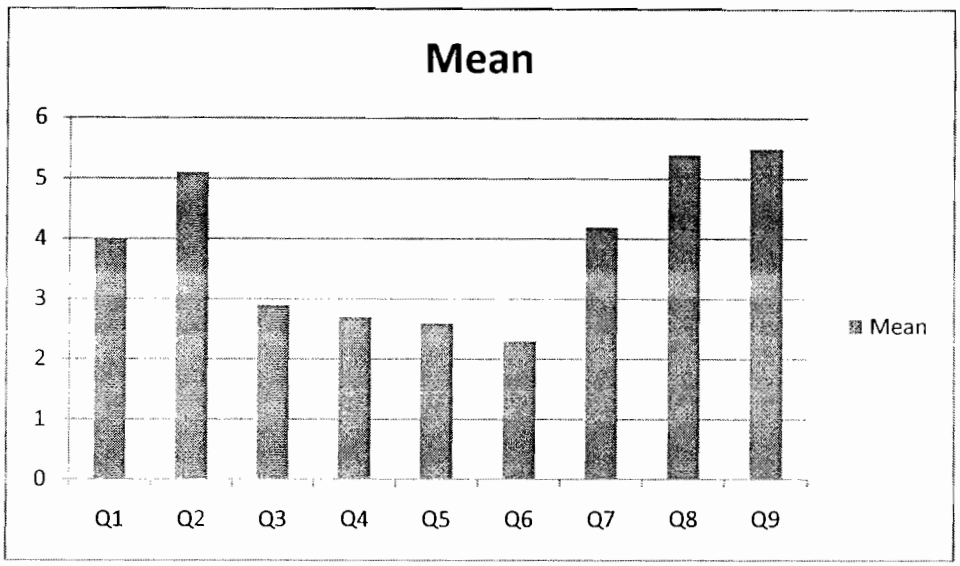

Figure 5.10: Participant satisfaction for TASKC

The proposed solution shows that the intelligent agent technology has contributed to the automation processes of automated organizing emails application and using it among the community and reduces human intervention. These processes could be done using autonomous intelligent agent technology developed, that will act on behalf of the members of the intelligent agent and workable at any time as long as users using and deposits the knowledge throughout the system.

5.3 Discussion

Based on the above research analysis, it is considered that the most relevant factors for the successful implementation of momentum for automated organizing emails application using intelligent agent technology are:

TASKA: organizing emails application needs to be nurtured enabled within and aligned with

organizational objectives. The underlying concern is organizing emails application employees do not want to prove their knowledge. Successful organizing emails application organizations empower employees to want to share and contribute intellectual knowledge of intelligent agent, by rewarding them for such actions. And, with organizing emails application organizational leader's role models of interface regularly with organizing emails application staff, teams and stakeholders in review sessions and openly talk about successes and failures.

TASKB: The first important variable is intelligent agent leadership with a vision, strategy and ability to promote change of the management to a compelling intelligent agent actively promoted by the Chief Executive that clearly articulates how intelligent agent contributes to achieving organizing emails application organizational objectives. A specialist intelligent agent team to aggressively manage knowledge property i.e., manage intellectual assets as routines-process, appropriate technology.

TASKC: This interview guide was used during all the interviews. However, separate interviews were used. Before conducting the interviews, the intelligent agent system was contacted to assign the responsible or grant permission to contact the recognized expert in the concerned area or field of activity for the topic. The participants verified and checked our system before solving the questions. The participants found that the MAS in this part were the task.

TASKD: This part is described our system and how the demonstrated in the system and how the agents called the other agents and the ability of agents to passed their parameters. According to the last question of this part and the comments of the participants we observed

the all participants gave "yes" to this question and that mean our system were achieved their goal.

5.4 Conclusion

Based on the survey conducted, almost 84% of the participants agreed, that in order to ensure our automated organizing emails application based intelligent agent system is utilized and helpful as well as is a successful in the organization; there are some intelligent agent critical success factors that could be considered. Firstly is the role of members in the intelligent agent community that should be worked with the system more aggressive. These include the issues of their willingness to deposit the knowledge into the system for the benefits of the agent community. Another issue is the infrastructure and technological requirement which involves people who are responsible to the system, and to ensure that it would be stabilize round the clock, because intelligent agent will work automatically at any time over the computer network and based on scripting given to them in the client and server based environment.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

This research has discussed concept and definition of the intelligent agents and other issues regarding the email applications. An overview on email organizing has been discussed also. Finally, this chapter has outlined the perception and previous related work, which eventually helped in determining the previous agent techniques in different email services, based certain approaches. The literature review for usability model with web application, web accessibility, users and tasks, evaluation method, data analysis, usability testing, usability index, and usability evaluation for an existing university web has been described.

This research employed the research methodology by Vaishnavi and Kothari (2007) as a guideline for the whole research process and this methodology has carefully choose System Research Process Methodology by Nunamaker *et al.* (1990), in order to develop the prototype for this study. This study focuses on the four phases lead to produce the proposed Automatic organize E-mail application.

Usability model use the three main criteria effectiveness was measured by the number of tasks successfully completed, efficiency was measured by amount of time taken to complete the tasks, and satisfaction was measured by a rating scale for several satisfaction elements. The evaluation was performed to determine the level of functionality and operability of the system after the system has been developed; it is tested based on the list of requirements in

chapter four for the system. The aim is to see the level of functionality and operability of the prototype system.

Selecting a suitable methodology is crucial in application development. Practicing in full discipline each activity in every phase is important to ensure the success of the system development. This would help in achieving a quality products and also helps to save time and cost in the production of the system.

It can be concluded that based on the characteristics of emails application, organizing and filtering based intelligent agent architecture supports higher organizing and filtering irrespective of its location and resolve a task based on planning algorithms using intelligence agents. Our implementation of this architecture will be fully focused on building the agents and not inclusive of the network simulation.

The system is based on Intelligent Agents, consisting of OA, FA and one leader and control interaction agents CA (Control Agent). The agent is designed using Prometheus methodology and will be developed using FIPA compliant JADE agent framework in next chapter.

Based on the survey conducted, almost 84% of the participants agreed, that in order to ensure our automated organizing emails application based intelligent agent system is utilized and helpful as well as is a successful in the organization; there are some intelligent agent critical success factors that could be considered. Firstly is the role of members in the intelligent agent community that should be worked with the system more aggressive. These include the issues of their willingness to deposit the knowledge into the system for the benefits of the agent community. Another issue is the infrastructure and technological requirement which involves

people who are responsible to the system, and to ensure that it would be stabilize round the clock, because intelligent agent will work automatically at any time over the computer network and based on scripting given to them in the client and server based environment.

6.2 RECOMMENDATIONS

To sum up, organizing emails application based on intelligent agent techniques needs to be led by the needs of the activity and the nature of the emails application knowledge, not by the technology or systems available. Even if a personalization strategy is adopted, technology can be relevant, and for a codification strategy a computer system is usually central.

Some people are easier to work with than others when it comes to knowledge acquisition. If participation in our system is optional, then this is not an issue, but where such participation is either compulsory or essential, there could be major problems. Addressing them will require effort.

Simply leaving people to get on with it themselves will not be effective. Some enthusiasts and early adopters will always co-operate, but the majority will not. This co-operation can extend as widely as a whole organizing emails application based on intelligent agent techniques system, but most intelligent agent systems are temporary, whereas the more important the organizing and filtering emails application is to an emails application organization.

In addition, where knowledge archiving and sharing is concerned, it may not be adequate to accept people's own version of what it is that they do. However, there are many MAS techniques that can be used to help elicit and validate people's knowledge.

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APPENDIX A
QUESTIONNAIRE SHEET

Appendix A.1 Pre-Survey Questionnaire

Thank you very much for agreeing to participate in this experiment. All of your personal data that we collect will be entirely confidential. I would like to gather a bit of background information about u.

Participant Name_____

Gender: _____Male _____Female

Date_____

How old are you? 20-29 30-39 40-49 50-59 60 or above

Level of education:

_____Certification Bachelor _____ Certification Diploma

_____Degree Postgraduate

Race: _____Malaysian (Local) _____International

Years of Experience _____

Appendix A.2 Usability Testing Questions

The goal of this Survey to evaluate our intelligent agent for automatic organizing and filtering emails application by using Usability evaluating questions and prove our system is a useful support system.

I will ask you a series of questions and would like you to think out loud while you look for the answer. Please remember that we are testing the effectiveness of our system and this is not a test of you. The whole test should take less than one hour. Thank you

Description for How to Answer the Question:

Evaluation of the matrix: Assign yourself the following points for each

NA = 0, where 0 is doing nothing at all = NONE and

1 = Don't Know, Not Sure or Can't Say = NO

2 = Not Important or as Not been Addressed = MINIMALLY

3 = Partially Beneficial or somewhat Effective or Less Scope for Overall Improvement =

PARTIALLY

4 = Important or May not be effective but other associated necessary actions being taken =SUBSTANTIALLY

5 = Critical or already in place and effective = FULLY

Also, the scale can generally be summarized as follows for majority situations

'NA 1 2 3 4 5' is calibrated as in

'5 (Always) 4 (Often) 3 (Sometimes) 2 (Occasionally) 1 (Never)'

NA (Not Applicable), (Note: "NA" and "1" scale values are equivalent.)

QUESTIONNAIRE - Part One (Quantitative Analysis)

1. Is organizing or filtering emails application knowledge a routine and like any other daily habits for the emails application's employees?

NA 1 2 3 4 5

2. Are the emails application's employees co-operative and helpful when asked for some information or advice?

NA 1 2 3 4 5

3. Is organizing or filtering emails application seen as strength and knowledge hoarding as a weakness?

NA 1 2 3 4 5

4. Is good knowledge management behavior like organizing or filtering emails application knowledge actively promoted on a day-to-day basis?

NA 1 2 3 4 5

5. Are people in the organizing or filtering emails application organization aware of the need to proactively manage emails application's knowledge assets?

NA 1 2 3 4 5

6. Do people at all levels in the organizing or filtering emails application organization participate in some kind of a community or communities of practice?

NA 1 2 3 4 5

7. Is there top management representation for organizing or filtering emails application?

NA 1 2 3 4 5

8. Is knowledge management a formal function area in the organizing or filtering emails application organization?

NA 1 2 3 4 5

9. Are the teams in the organizing or filtering emails application organization effective and self managed teams composed of individuals capable of learning from each other?

NA 1 2 3 4 5

QUESTIONNAIRE- Part Two (Qualitative Analysis)

1. Do the organizing or filtering emails application employees share their knowledge?

Yes No

2. Is the intranet used to organizing or filtering emails application knowledge in an informal manner (non-routine, personal and unstructured way)?

Yes No

3. Do workplace settings and format of meetings encourage informal knowledge exchange?

Yes No

4. Are there incentives given for knowledge contribution, exchange or on organizing or filtering emails application knowledge in your firm?

Yes No

5. Is the support from executive management to organizing or filtering emails application \ knowledge VISIBLE?

Yes No

6. Are there specific organizing or filtering emails application knowledge roles identified and assigned?

Yes No

7. Are all senior managers and professionals trained in organizing or filtering emails application techniques?

Yes No

8. Knowledge agents validated through peer or superior review?

Yes No

9. Knowledge sharing across agents boundaries actively encouraged?

Appendix A.3 Post-Survey Questionnaire

Thanks again for participating in this experiment. This questionnaire gives you an opportunity to tell us your reactions to the system you used. Please circle a number on the scale to indicate your reactions. Thank you

The goal of this part is to evaluate our system to prove that our system will help the emails application users according to their needs.

QUESTIONNAIRE - Part One (Quantitative Analysis)

1. Is it possible to change organize or filter agent schedule.

NA 1 2 3 4 5

2. We can run organize or filter agent "After new mail arrives" and "Before new mail arrives".

NA 1 2 3 4 5

3. Organize or filter agent option will appear in the current mail file.

NA 1 2 3 4 5

4. One of our users left the office without enabling organizes or filters agent. We can enable it for him or her.

NA 1 2 3 4 5

5. To customize the "Welcome Back" message, the "Disable Reminder" message, or the default wording of organize or filter e-mail notifications sent to all senders of e-mail.

NA 1 2 3 4 5

6. Organize or filter agent work in a clustered environment.

NA 1 2 3 4 5

7. We can enable organize or filter agent for leaving "Today" instead of the recommended "Tomorrow" or another date in the future.

NA 1 2 3 4 5

8. Organize or filter agent work in a clustered environment.

NA 1 2 3 4 5

9. We can enable organize or filter agent for leaving "Today" instead of the recommended "Tomorrow" or another date.

NA 1 2 3 4 5

QUESTIONNAIRE- Part Two (Qualitative Analysis)

1. We can set the organizing agent for an absence period of a half day or a few hours.

Yes No

2. We can set the filtering agent for an absence period of a half day or a few hours.

Yes No

3. Whenever we receive a warning in Designer while attempting to save an agent "You do not have execution access privileges for this agent on server ". This indicates one of two things: either the agent signer does not have the rights on the scheduled server, or that server is not reachable to check the signer rights. Running agent "test" in the Designer will give you a better indication.

Yes No

4. "Do you know why I get 'Object variable not set'?" This is a result of a logic error in the code. The problem should become clear if you single step through the code in debugger (File - Tools –JAVA Script debugging). Server might be configured to delay execution of your agents.

Yes No

5. If these tips don't help you figure it out on your own, when you post in the forum please include in your post screen shot of server log output with agent manager debug flags set to '*' (best) and/or diagnostic output of "agent test" (a good second choice when you don't have access to the server log).

Yes No

6. It is possible to pass parameters between agents.

Yes No

7. It is easy to console commands for organize from organize agent.

Yes No

8. It is easy to console commands for filter from filter agent.

Yes No

9. Does the agents that applied will help the users of the system?

Yes No

Comment about the system:

_____
_____
_____
_____.